EFFECTS OF MOTIVATIONAL AND VOLITIONAL INTERVENTIONS ON ADOLESCENTS' PHYSICAL ACTIVITY BEHAVIOR

by

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STATEMENT OF DISSERTATION APPROVAL

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ABSTRACT

To overcome the threat of overweight/obesity in adolescents, theory-based interventions promoting physical activity (PA) participation have been widely advanced. Protection motivation theory (PMT) has been moderately effective in the prediction of health-related behavior. Implementation intention (a volitional strategy) interventions have been successful in changing a range of health behaviors. This study examined the impacts of PMT-based motivational intervention and implementation intention-based volitional interventions on PMT constructs, PA intention and behavior. The study also compared the cognitions of PMT constructs, PA intention and behavior between overweight/obese adolescents and normal weight adolescents. Finally, the study tested the predictive strength of PMT constructs on PA intention and behavior among adolescents.

A total of 330 junior high school students were assigned to either a control group or one of the two experimental conditions: motivational intervention or a motivational plus volitional intervention. Motivational intervention included reading a leaflet about overweight/obesity and the effects of PA on preventing the threat. Volitional intervention involved asking participants to plan when and where they would participate in PA. Participants' PMT constructs, PA intention and behavior were measured at three time-points over a four-week period.

MANOVA with repeated measure yielded a nonsignificant main effect for interventions on PMT constructs, PA intention and behavior, whereas a significant main effect for weight category on PMT constructs, intention and behavior was detected. Follow-up tests indicated that overweight/obese adolescents reported significantly higher perceived vulnerability and response cost, and lower self-efficacy, physical activity intention, and behavior than normal weight adolescents did. Hierarchical regression revealed that the entire PMT model accounted for 14% of variance in PA behavior. Specifically, intention, perceived vulnerability, and response cost were significant predictors of PA behavior. Additionally, PMT constructs explained 40% of variance in intention. Self-efficacy and response cost emerged as significant predictors of intention.

The findings indicated that compared to the control group the interventions were not effective in promoting adolescents' PA intention and behavior. However, the evidence for the utility of PMT in predicting PA intention and behavior among adolescents was provided. Overweight/obese adolescents need to enhance their self-efficacy and reduce their perceptions of PA costs.

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CHAPTER 1

INTRODUCTION

Background

It has been well-documented that regular participation in physical activity has a positive influence on individuals' health and well-being (Roberts & Barnard, 2005). Children and adolescents who are more physically active are less at risk for chronic diseases such as obesity and type 2 diabetes (Strong et al., 2005). It has been recommended that adolescents should engage in physical activity of moderate to vigorous intensity (MVPA) for at least 60 minutes and up to several hours daily for enhanced health benefits and weight control (Biddle, Gorely, & Stensel, 2004; Cavill, Biddle, & Sallis, 2001; Strong et al., 2005). However, reports indicate that 92% of adolescents are not meeting the guidelines of engaging in physical activity at least 60 minutes daily (Troiano et al., 2008). Physical activity levels decline as youth age, and a substantial number of adolescents are not sufficiently active (Biddle, et al., 2004; Sallis, 2000). Considering the above facts, interventions designed to promote youth physical activity participation would be of considerable value.

The revised Protection Motivation Theory (PMT; Rogers, 1983) has the potential to account for the cognitive mediation process and the major determinants of physical activity participation, particularly in the context of health-protective behaviors. Many

studies have suggested that PMT has appeared to be useful in the prediction of and intervention implementation in health-related behaviors (Floyd, Prentice-Dunn, & Rogers, 2000; Milne, Sheeran, & Orvell, 2000; Plotnikoff & Trinh, 2010; Rogers, 1975, 1983). The PMT was originally developed in 1975 by Ronald Rogers in an attempt to explain the mechanisms behind the attitudinal and behavioral change that individuals undertake when faced with a real or perceived threat to their health (Rogers, 1975).

Based on the most current full model of PMT, Rogers (1983) proposed various environmental (e.g., fear appeals) and intrapersonal (e.g., personality) sources of information must be obtained before cognitive mechanisms are initiated. A cognitive mediating process begins once information about a health threat is received. Individuals must evaluate between two types of responses: a maladaptive response and an adaptive response. When evaluating the maladaptive response, one engages in a threat appraisal process. Threat appraisal is the result of an individual judging the intrinsic and extrinsic rewards associated with the unhealthy alternative (e.g., playing video games rather than completing planned exercise) less his/her perceptions of the severity of the threat and his/her perceptions of vulnerability to the threat. The theory inferred that as perceptions of vulnerability and severity increase, the likelihood of participating in the unhealthy alternative decreases. However, the likelihood of continuing the unhealthy behavior is increased by the perceived intrinsic rewards (e.g., enjoyment, pleasure) and extrinsic rewards for that behavior (e.g., approval by peers; Rogers, 1983).

One will engage in a coping appraisal when evaluating adaptive response. The coping appraisal process is a cognitive process whereby an individual assesses the value of a coping strategy and the ability to avert the dangers of a given threat. It is the result of

an individual's perception of response efficacy (i.e., will physical activity lead to weight lost and then decrease the risk of obesity-related diseases effectively) and self-efficacy (i.e., the belief in one's personal ability to complete physical activity) when considering the perceived costs of completing the adaptive response (i.e., physical activity). Response efficacy is the perception that a particular coping strategy will effectively work to avoid the dangers of the threat. Self-efficacy refers to one's own belief that they can effectively carry out the adaptive response. Response cost, on the other hand, inhibits performance of the adaptive behavior. Response cost can be any cost (e.g., physical, psychological, social, monetary) that might reduce the probability of using the adaptive response. According to PMT, people's intention to adopt an adaptive response (protection motivation) is the function of an individual's threat appraisal and coping appraisal. However, most research and applications of the PMT consider the effects of five main constructs (perceived severity, perceived vulnerability, self-efficacy, response efficacy, and response cost; Lippke & Plotnikoff, 2009; Milne, Orbell, & Sheeran, 2002; Plotnikoff & Trinh, 2010; Zhang & Cooke, 2012).

Two forms of research have been undertaken to test PMT: (a) the main components of PMT are manipulated within persuasive communications to explore the effects of the intervention on subsequent beliefs, intentions, and behaviors; and, (b) PMT is used to predict health behavior. Two meta-analyses (Floyd et al., 2000; Milne et al., 2000) and two reviews (Norman, Boer, & Seydel, 2005; Plotnikoff et al., 2010) have summarized the findings from PMT studies across various behaviors. Overall, the PMT has been moderately effective in predicting health-related and safety-related intentions and behaviors in various contexts. The effects of PMT-based health education interventions have

also been examined (Fry & Prentice-Dunn, 2006; McClendon & Prentice-Dunn, 2001; Milne et al., 2002; Schaffer & Tian, 2004). In these studies, the intervention group received information about a health threat and suggested preventive behaviors, while the control group received no information. The results of these studies showed that the interventions significantly affected PMT constructs and intentions, but had limited effects on behavior.

PMT has also been employed in the physical activity domain. Some studies have tested PMT in the physical activity domain without using any interventions (Plotnikoff, et al., 2010; Plotnikoff & Higginbotham, 2002; 1998; Plotnikoff, Rhodes, & Trinh, 2009; Tulloch et al., 2009). These studies suggested that the coping appraisal constructs were generally supported; however, there was limited support for the threat appraisal constructs.

Seven studies explored the effects of manipulating specific PMT constructs on cognitions of PMT constructs, intention, and behavior (Courneya & Hellsten, 2001; Fruin et al., 1991; Graham, Prapavessis, & Cameron, 2006; Milne et al., 2002; Stanley & Maddux, 1986; Wurtele & Maddux, 1987; Zhang et al., 2012). All of the manipulations were provided with motivational essays or videos based on PMT constructs. These studies related to the primary prevention of health-related issues through physical activity or exercise. The findings of these studies indicated that experimental manipulations were generally very effective in influencing subsequent cognitions and intention. However, as Milne et al. (2000) have illustrated in a review, the effectiveness of these experimental manipulations in influencing subsequent behavior was limited.

Among the aforementioned seven studies, three studies (Graham et al., 2006; Milne et al., 2002; Zhang et al., 2012) employed factual information to examine the effects of a PMT-based health education intervention on behavioral intentions. Specifically, in the study by Graham et al. (2006) one group received information regarding the susceptibility and severity of colon cancer, evidence linking colon cancer and exercise, and some common methods to help increase one's response efficacy and self-efficacy for engaging in more exercise and a control group received no information. This intervention improved early exercise behavior (2 weeks postintervention) but did not improve longer period exercise behavior (4 weeks postintervention). In the study conducted by Milne et al. (2002), participants in experimental groups were asked to read a health education leaflet, which was developed based on PMT constructs. The leaflet provided factual information about coronary heart disease and the benefits of exercise. This motivational intervention significantly increased threat and coping appraisal and intentions to engage in exercise but did not bring about a significant increase in subsequent exercise behavior. Zhang et al. (2012) also reported in a similar study that a motivational intervention had significant positive effects on PMT constructs, intentions, and the physical activity behavior. Thus, further research is needed to seek the best ways of manipulating PMT constructs with a factual health education intervention and to examine the effects of such a health education intervention on subsequent PMT cognitions, intention, and behaviors.

In real-life health education settings, it is important to establish that the effects of an intervention last over a certain period of time. The success of the intervention reported by many previous studies tended to be measured immediately following the manipulation (Milne et al., 2002). Thus, cognitive change was measured when the information is still

fresh in the minds of the participants (Wurtele & Maddux, 1987). Two studies included all PMT constructs in longitudinal health education intervention studies and measured the stability of the effects of the interventions on subsequent changes in cognitions, intention, and behaviors in a longitudinal design. Milne et al. (2002) found the PMT-based motivational intervention significantly increased threat and coping appraisal and intentions to engage in exercise, but did not bring about a significant increase in subsequent exercise behavior. They also found that all cognitive changes induced by the health education leaflet on PMT constructs remained stable over the 2-week period after the PMT-based motivational intervention. Results from the study by Graham et al. (2006) indicated that compared to the control groups, the PMT intervention group scored significantly higher on response efficacy and intention to engage in more exercise. The intervention improved early exercise behavior (2 weeks postintervention), but did not improve longer period exercise behavior (4 weeks postintervention). The present project examined the effects of PMT-based intervention and combined PMT-based motivational and volitional intervention in 2-week and 4-week periods.

As discussed above, researchers have found that experimental manipulations to PMT constructs are generally effective in influencing subsequent cognitions and intention. However, the influence of such experimental manipulations to subsequent behavior change is limited and inconsistent (Floyd et al., 2000; Milne et al., 2000). One reason that PMT-based interventions do not always change behavior is that changing motivation is only the first step to change behavior. Several researchers have argued that there are two stages (motivational and volitional) through which people pass before acting (Gollwitzer, 1993; Heckhausen, 1991). The motivational stage is concerned with increasing people's

orientation toward enacting the behavior and culminates in the formation of a behavioral intention. The volitional stage culminates in the actual performance of the behavior in question (e.g., sedentary) and is important in translating motivational cognitions into action (Gollwitzer, 1993; Heckhausen, 1991). Thus, the model of action phases suggests that behavior is most likely when the individual is both motivated to act (motivational stage) and has developed strategies and plans that promote behavioral enactment (volitional stage). This suggests that a motivational model such as PMT could usefully be supplemented by volitional strategies in order to increase the likelihood of performing health behaviors.

Gollwitzer's (1993, 1999) concept of implementation intentions is an important volitional strategy to explore the ways in which motivation is translated into action. Behavioral intentions tap the extent to which individuals are motivated to act, and implementation intentions are regarded as important in translating that motivation into action (Gollwitzer, 1993, 1999). Consistent with this idea, implementation intentions are effective only when people are at least somewhat motivated to act (Armitage, 2006). Forming implementation intentions has been proposed as a potentially effective and inexpensive intervention (Gollwitzer, 1993, 1999). Implementation intentions are self-regulatory strategies and simply ask participants to plan when, where, and how they will exercise. To date, numerous published experimental studies have suggested that implementation intention interventions are successful in promoting a range of health behaviors, such as cancer screening behaviors, healthy eating, smoking cessation, and binge drinking cessation (Gollwitzer & Sheeran, 2006; Koestner, Lekes, Powers, & Chicoine, 2002; Sheeran, 2002), as well as physical activity (Armitage & Sorigg, 2010; Kwak, Kremers, Van Baak,

& Brug, 2007; Luszczynska &Haynes, 2009; Prestwich, Perugini, & Hurling, 2010; Roberts, Maddison, Magnusson, & Prapavessis, 2010; Scholz, Knoll, Sniehotta, & Schwarzer, 2006; Sniehotta, Scholz, & Schwarzer, 2006). Milne et al. (2002) suggested implementation intentions used with the PMT-based motivational interventions significantly increased exercise behavior over one week, whereas targeting the components of the PMT, without the use of implementation intentions, did not. This indicated that combining PMT-based motivational intervention with implementation intention (a volitional strategy) intervention may be more effective than using PMT-based motivational interventions only. The present study will add to the growing literature on the role of implementation intentions in health psychology by assessing their utility within the framework of PMT.

Research suggests that obesity has a far reaching effect on the health of many Americans (Mokdad et al., 2003; Mokdad et al., 2004). Children and adolescents in the United States have not escaped the obesity epidemic. Sources from Ogden et al. (2010) revealed that 31.7% of children and adolescents are overweight or obese. Being overweight during childhood and adolescence increases the risk of developing hypertension, high cholesterol, respiratory ailments, type 2 diabetes, orthopedic complications, coronary heart disease, stress on weight-bearing joints, and depression (American Obesity Association, 2002; CDC, 2006; Krebs & Jacobson, 2003; Must & Strauss, 1999; Reilly et al., 2003). Overweight adolescents have a 70% chance of becoming overweight or obese adults, which increases to 80% if one or more parent is overweight or obese (Torgan, 2002). Overweight in adolescents is generally caused by a lack of physical activity, unhealthy eating patterns resulting in excess energy intake, or a combination of the two.

Moreover, there is more support for the adoption of physical activity as a means of averting the health risks involved with being overweight or obese (CDC, 2006; Mokdad et al., 2003). Obviously, obesity or overweight has been a health threat to adolescents. As PMT was specifically developed to explain health behavior motivation based on a disease prevention or health threat perspective, it was chosen as a theoretical model in this study to explain physical activity intentions and physical activity behaviors based on the prevention of obesity or overweight in such a population. Although the PMT model shows promise in predicting the likelihood that individuals will adopt healthier lifestyle trends, no studies have attempted to compare the effects of the PMT constructs in predicting physical activity intention and behavior, and the effects of manipulating PMT constructs on physical activity intention, and behavior between adolescents with a health threat (overweight/obesity) and adolescents without a health threat (normal weight). This study was designed to assess the differences on cognitions of PMT constructs and effects of PMT-based intervention between overweight/obese adolescents and normal weight adolescents.

Problem Statement

Relevant meta-analyses and reviews (Floyd et al., 2000; Milne et al., 2000; Norman et al., 2005; Plotnikoff & Trinh, 2010) have summarized that PMT has been moderately effective in predicting health-related and safety-related intentions and behaviors in various contexts including the physical activity domain. However, only two studies (Fruin et al., 1991; Sturges & Rogers, 1996) included adolescents; thus, the PMT's effect in predicting intention and behavior among this population needs further examination.

Among the seven intervention studies, three studies (Graham et al., 2006; Milne et al., 2002; Zhang et al., 2012) employed factual information instead of false information. No study focused on adolescents. Furthermore, all seven studies used risks of cardiovascular disease and cancer as health threats. It is not clear whether manipulating PMT constructs can improve adolescents' cognitions of PMT constructs, physical activity intention and behavior when obesity is employed as the health threat.

Although the PMT model shows promise in predicting the likelihood that people will adopt healthier lifestyle trends, no studies have compared the effects of PMT in predicting physical activity intention and behavior, and the effects of manipulating PMT constructs on cognitions of PMT constructs, physical activity intention and behavior between adolescents with a health threat (overweight/obesity) and adolescents without a health threat (normal weight). Furthermore, no studies examined if health threat moderated the relationship between PMT constructs and physical activity intention, or physical activity behavior. Therefore, the potential moderating effects of health threat (obesity) on the relationship between PMT constructs and physical activity intention or physical activity behavior needs further examination.

A previous PMT-based intervention (Milne et al., 2002) produced a significant effect in changing cognitions of PMT constructs and increasing intention to exercise. This effect was stable over a 2-week period after intervention. However, the motivational intervention did not significantly affect the subsequent exercise behavior. Graham et al. (2006) indicated the PMT-based intervention increased coping appraisal constructs and intention to engage in more exercise. The intervention improved early exercise behavior (2 weeks postintervention) but did not improve a longer period of exercise behavior (4

weeks postintervention). These inconsistent results lead the present project to examine the effect of an intervention over periods of 2 and 4 weeks.

To date, there are only two studies (Milne et al., 2002; Zhang et al., 2012) that have tried to augment a motivational manipulation with an implementation intention intervention. The results showed that combining implementation intention intervention and PMT-based intervention brought about a significant increase in exercise behavior. This conclusion needs more evidence supplied by additional studies, especially with other populations like adolescents.

Purposes

The purposes of this study were:

1. To investigate whether a motivational intervention manipulating all PMT constructs by employing a factual health education leaflet will change adolescents' cognitions of PMT constructs, physical activity intention, and behavior.

2. To examine whether combining PMT-based intervention with an implementation intention intervention will improve the likelihood of adopting physical activity behavior.

3. To examine the differences of adolescents' perception of PMT constructs, physical activity intention, and physical activity behavior between overweight/obese adolescents and normal weight adolescents.

4. To examine the predictive strengths of PMT constructs on physical activity intention and physical activity behavior among adolescents, and to determine whether weight category moderate relationships between PMT constructs and physical activity intention or physical activity behavior.

Hypotheses

Hypotheses for purpose 1:

a. The PMT-based motivational intervention will increase cognitions of self-efficacy, response efficacy, perceived severity, perceived vulnerability, and reduce response costs compared to the condition without the motivational intervention.

b. The motivational intervention will increase intention to engage in at least 60 minutes of physical activity daily over the following 2 weeks compared to the condition without the motivational intervention.

c. The effects of the motivational intervention on cognitions to PMT constructs and physical activity intention will remain stable over the following 4 weeks after intervention.

Hypotheses for purpose 2:

The addition of an implementation intention intervention to the PMT-based motivational intervention will increase adolescents' participation in at least 60 minutes of physical activity daily over the following 2 weeks compared to the conditions without any interventions and with the motivational intervention only.

Hypotheses for purpose 3:

a. Overweight/obese adolescents will rate their personal cognitions about the severity of the threat and personal vulnerability to the threat as higher than normal weight adolescents.

b. Overweight/obese adolescents will rate their personal self-efficacy and response efficacy as lower than normal weight adolescents.

Hypotheses for purpose 4

PMT constructs will be significant predictors to adolescents' physical activity intention and physical activity behavior.

Definition of Terms

Coping appraisal is how one responds to the situation of a health threat and consists of response efficacy, self-efficacy, and response costs (Rogers, 1983).

Implementation intentions are "if-then" plans that work by linking in memory a critical situation ("if") with an appropriate behavioral response ("then"). The idea is that specifying where, when, and how one will act ensures that the appropriate behavioral response will be triggered at the appropriate time and place in the future (Gollwitzer, 1993, 1999).

Intentions are indicators of how hard people are willing to try or how much effort they are planning to exert in order to perform the behavior (Ajzen, 1991).

Perceived severity refers to the degree of harm (e.g., psychological, physical, social, etc.) that a person may incur if the maladaptive behavior is continued (Rogers, 1983).

Perceived vulnerability refers to the likelihood that the threat will occur if no changes are made to the maladaptive behavior (Rogers, 1983).

Protection Motivation Theory is a major health psychology theory aimed at explaining the cognitive mediation process of behavioral change in terms of threat and coping appraisal (Rogers, 1983).

Response cost is any costs (e.g., physical, psychological, social, monetary) associated with the recommended behavior (Rogers, 1983).

Response efficacy is the individual's expectancy that carrying out recommendations can remove the threat (Rogers, 1983).

Self-efficacy is the belief in one's ability to execute the recommended courses of action successfully (Rogers, 1983).

Threat appraisal assesses the severity of the situation of a health threat and examines how serious the situation is. It is composed of perceived severity and perceived vulnerability (Rogers, 1983).

Assumptions

In the present study, it was assumed that:

1. Participants understood the questionnaires and responded to them truthfully to the best of their ability.
2. Participants represent a normal population of 7^{th} to 9^{th} school students.
3. Participants understood the leaflet developed for the interventions very well.
4. Participants were not disturbed by the investigators or assistants.
5. Participants' responses are not influenced by their peers.
6. Participants understood and followed the directions concerning the study.

Delimitations

The elements controlled in this study were:

1. Participants were delimited to 7^{th} to 9^{th} graders enrolled at schools in the Mountain West Region of the U.S.
2. Individuals with physical impairments that would impede their ability to participate in physical activity and individuals with cognitive or decisional im-

pairment or who are mentally disabled were excluded from participating in this study.

3. Participants answered the questionnaires on a voluntary basis.

Limitations

Limitations in this study were:

1. Participants selected only from 7th to 9th grades enrolled at schools in the Mountain West Region of the U.S., which may limit the generalizability of the results of this study.
2. Different levels of participants' previous knowledge on the threat of overweight/obesity, and the link between overweight/obesity and physical activity may influence their responses.
3. Most of the data were voluntarily collected using self-report instruments.
4. Variation may exist in gender, grade, and socioeconomic status.

Significance

The significance of this study was as follows:

First, this study provided further examination on PMT's effect in predicting intention and behavior among adolescents, which would help adolescents and professionals further understand the psychological factors related to adolescents' physical activity intentions and behaviors.

Second, the results of this study provided information about how to develop interventions to promote adolescents' physical activity based on motivation theory, and thus help professionals to develop more effective interventions.

Third, the results from different weight adolescents helped professionals decide whether they need to take different measures when developing interventions for over-weight/obese adolescents and normal weight adolescents.

Fourth, the results from this study over periods of 2 and 4 weeks provided information to help health education professionals decide whether the relevant knowledge needs to be repeated to students.

Lastly, the effects of combining motivational and volitional interventions would help physical activity professionals or educators form the idea that they should focus on a combination of various theories instead of a single theory.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the present situation of adolescents' overweight/obesity and physical activity participation was summarized. Then, the PMT model was explained and previous studies on the applications of PMT were reviewed. Finally, the implementation intention was introduced and previous studies on combining PMT-based motivational intervention with implementation intention intervention were reviewed.

Adolescents' Overweight/Obesity and Physical Activity Participation

Overweight and Obesity in Adolescents

Children and adolescents' overweight and obesity, defined as a body mass index (BMI) greater than or equal to the 85th and 95th percentile for age and sex respectively (CDC, 2011), have increased dramatically during the past several decades. The trends in overweight and obesity in U.S. children and adolescents suggest the escalating problem of excess weight has now reached epidemic proportions (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Data collected as a part of the 2007-2008 National Health and Nutrition Examination Survey (NHANES) revealed that 31.7% of 2 to 19-year-old U.S. children and adolescents are at or have exceeded the 85th percentile for BMI based on age and sex,

with 16.9% of these children and adolescents meeting or exceeding the 95th percentile for BMI by age and sex. The rate of overweight or obesity for 2-5 year olds, 6-11 year olds, and 12-19 year olds are 21.2%, 35.5%, and 34.2% respectively, whereas the obesity rates are 10.4%, 19.6%, and 18.1%, respectively (Ogden et al., 2010). This prevalence has more than tripled in the past three decades since 1980.

Obesity in children and adolescents is associated with a range of health problems. Obese children and adolescents are more likely to be obese as adults (U.S. Surgeon General, 2001) and also have an increased risk of coronary heart disease in adulthood (Owen et al., 2009). Overweight adolescents have a 70% chance of becoming overweight or obese adults, which increases to 80% if one or more parent is overweight or obese (Torgan, 2002). Research based on participants 5- to 17-year-olds showed that 70% of obese children and adolescents had at least one risk factor for cardiovascular disease (Freedman et al., 2007). In one longitudinal study, childhood obesity, insulin resistance, and hypertension were associated with an increased risk of premature death (Franks et al., 2010). In addition, childhood obesity has been associated with certain cancers, fatty liver disease, sleep apnea, asthma, joint disorders, and mental health issues (Barlow, 2007; Fennoy, 2010). The psychosocial alterations that may accompany overweight and obesity are of equal concern. As children and adolescents live with overweight and obesity, levels of self-esteem suffer (Wang & Veugelers, 2008) and quality of life is adversely influenced (Williams, Wake, Hesketh, Maher, & Waters, 2005). Therefore, children and adolescents with obesity are at greater risk for bone and joint problems, sleep apnea, and social and psychological problems such as stigmatization and poor self-esteem (Daniels et al., 2005; U.S. Surgeon General, 2001).

The causes of overweight and obesity among children and adolescents are multi-factorial. It is generally caused by a lack of physical activity, unhealthy eating patterns resulting in excess energy intake, or a combination of the two (Daniels et al., 2005). Moreover, there is more support for the adoption of physical activity as a means of averting the health risks involved with being overweight or obese (CDC, 2006; Mokdad et al., 2003).

Adolescents Physical Activity Participation

Participation in physical activity has a positive influence on individuals' health and well-being (Roberts & Barnard, 2005). Adolescents who are more physically active are less at risk for chronic diseases such as obesity and type 2 diabetes (Strong et al., 2005). Regular physical activity can have immediate health benefits by positively affecting body composition and musculoskeletal development (Malina, Bouchard, & Bar-Or, 2004). Reduced prevalence of coronary heart disease risk factors has been observed among active youngsters (Gutin et al., 1994).

It has been recommended that adolescents should engage in physical activity of moderate to vigorous intensity (MVPA) for at least 60 minutes and up to several hours daily for enhanced health benefits and weight control (Biddle, Gorely, & Stensel, 2004; Cavill, Biddle, & Sallis, 2001; Strong et al., 2005). However, reports indicate that 58% of U.S. children and 92% of adolescents are not meeting the guidelines of engaging in physical activity at least 60 minutes daily (Troiano et al., 2008). Physical activity levels decline as children and adolescents age, and a substantial number of adolescents are not sufficiently active (Biddle, et al., 2004; Sallis, 2000). Considering the above facts, interven-

tions designed to promote adolescents' physical activity participation would be of considerable value.

Protection Motivation Theory

Origin of the Theory

The protection motivation theory (PMT) was originally founded by Ronald Rogers in 1975 in order to better understand fear appeals and how people cope with them, or in other words, in an attempt to explain the mechanisms behind the attitudinal and behavioral changes that individuals undertake when faced with a real or perceived threat to their health (Rogers, 1975). The origins of PMT lie in early work on the persuasive impact of fear appeals that focused on the conditions under which fear appeals may influence attitudes and behavior (Norman, Boer, & Seydel, 2005). In 1983, Rogers extended the theory to a more general theory of persuasive communication, with an emphasis on the cognitive processes that mediate behavior change (Rogers, 1983).

Description of the Theory

The most current full model is described in Figures 1 and 2 (Rogers, 1983; Rogers et al., 1997). Rogers (1983, 1997) proposed various environmental (e.g., fear appeals) and intrapersonal (e.g., personality) sources of information must be first obtained before cognitive mechanisms are initiated. Environmental sources include verbal persuasion (e.g., threat appeals, information from friends, family, health professional, etc.) and/or observational learning (e.g., watching what happens to others who either deal with the

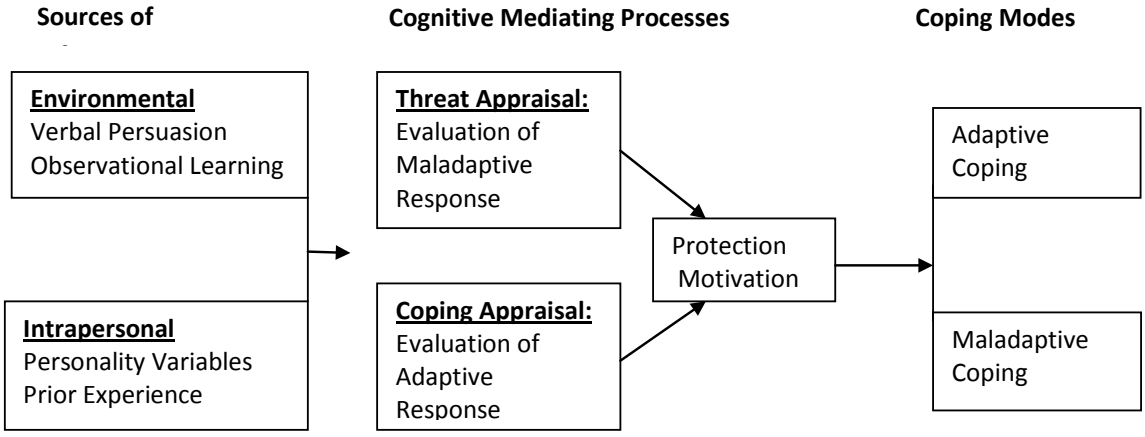

Figure 1. Overall model of Protection Motivation Theory

(Adapted from Rogers et al., 1997)

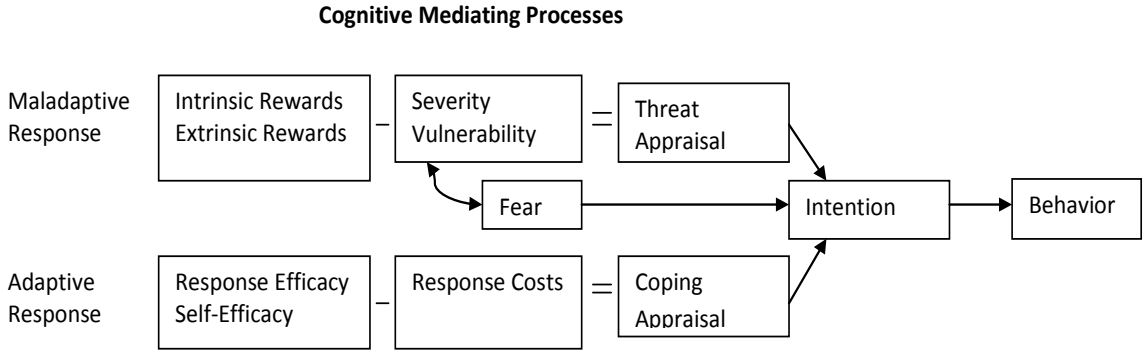

Figure 2. Cognitive mediating processes of Protection Motivation Theory

(Adapted from Rogers, 1983; Rogers et al., 1997)

threat or use the protective health behaviors to avert it). Intrapersonal sources involve personality variables (dispositional characteristics) and prior experience with similar threats.

A cognitive mediating process begins once information about a health threat is received. Individuals must evaluate between two types of responses: a maladaptive re-

sponse and an adaptive response. The maladaptive response is usually what the individual may be currently employing or is thinking about employing in the future. For example, an adolescent may currently be choosing to replace physical activity time with a sedentary alternative like playing video games or may be thinking of replacing physical activity time with a sedentary alternative like playing video games. When evaluating the maladaptive response, one engages in a threat appraisal process. Threat appraisal is the result of an individual judging the intrinsic and extrinsic rewards associated with the unhealthy alternative (e.g., playing video games rather than completing planned exercise) less her/his perceptions of the severity of the threat and her/his perceptions of vulnerability to the threat. The theory inferred that as perceptions of vulnerability and severity increase, the likelihood of participating in the unhealthy alternative decreases. However, the likelihood of continuing the unhealthy behavior is increased by the perceived intrinsic rewards (e.g., enjoyment, pleasure) and extrinsic rewards for that behavior (e.g., approval by peers; Rogers, 1983). The components of severity and vulnerability to a potential threat are used to determine the probability that maladaptive behavior will be discontinued. Severity refers to the degree of harm (e.g., psychological, physical, social, etc.) that a person may incur if the maladaptive behavior is continued. Vulnerability refers to the likelihood that the threat will occur if no changes are made to the maladaptive behavior (Rogers, 1975). Severity to overweight/obese adolescents may manifest itself through various conditions such as premature death, being diagnosed with various types of diseases, deficits in their day-to-day well-being, and social pressure (American Obesity Association, 2002; CDC, 2006). These factors, taken together, are all used to appraise the threat.

The coping appraisal process is a cognitive process whereby an individual assesses the value of a coping strategy and the ability to avert the dangers of a given threat. It is the result of an individual's perception of response efficacy (i.e., will physical activity lead to weight lost and then decrease the risk of obesity-related diseases effectively) and self-efficacy (i.e., the belief in one's personal ability to complete physical activity) when considering the perceived costs of completing the adaptive response (i.e., physical activity). Response efficacy is the perception that a particular coping strategy will effectively work to avoid the dangers of the threat. Self-efficacy refers to one's own belief that they can effectively carry out the adaptive response. Response cost, on the other hand, inhibits performance of the adaptive behavior. Response cost can be any costs (e.g., physical, psychological, social, monetary) that might reduce the probability of using the adaptive response.

The PMT hypothesizes that the motivation to protect oneself from danger is the function of four cognitive beliefs: (a) the threat is severe; (b) one is personally vulnerable to the threat; (c) the coping response is effective in averting the threat; and, (d) one has the ability to perform the coping response (Plotnikoff & Trinh, 2010). According to Rogers (1983), fear has an indirect effect on attitude by influencing the appraisal of the severity of the danger. Rippetoe and Rogers (1987) suggested that this effect may be detrimental to attitude change by inducing maladaptive coping, specifically avoidance. For example, if an obese adolescent feels that the severity of the health threat is too great, he/she may lose hope that he/she can prevent the health threat from occurring. This may be remedied, however, with a positive appraisal of their ability to cope with the health threat.

Schwarzer (1992) posited that Rogers' proposed full PMT (i.e., subtracting threat from extrinsic and intrinsic rewards and subtracting response cost from the coping appraisal) is considered untestable. Indeed, no PMT study has attempted to test the full model in this way. Most applications of PMT consider only the main effects of perceived severity, perceived vulnerability, response efficacy, self-efficacy, and response cost (Norman, Boer, & Seydel, 2005). Researchers explained the reasons why intrinsic rewards and extrinsic rewards have not been considered with the main PMT constructs. The distinction between the reward value of a maladaptive behavior and the cost of a preventative measure may not be clear (Abraham et al., 1994). The nature of the relationships between the cognitive mediators and the proposed additive principle (i.e., when combining components between the two appraisal processes, a second-order interaction effect should occur) have been considered unclear and internally inconsistent respectively (Fruin, Pratt, & Owen, 1992; Plotnikoff, 1994). Accordingly, most research and applications of the PMT consider the effects of five main constructs (i.e., perceived severity, perceived vulnerability, response efficacy, self-efficacy, and response cost) (Lippke & Plotnikoff, 2009; Milne et al., 2002; Plotnikoff & Trinh, 2010; Zhang & Cooke, 2012). Hence, the PMT can be conceptualized as Figure 3.

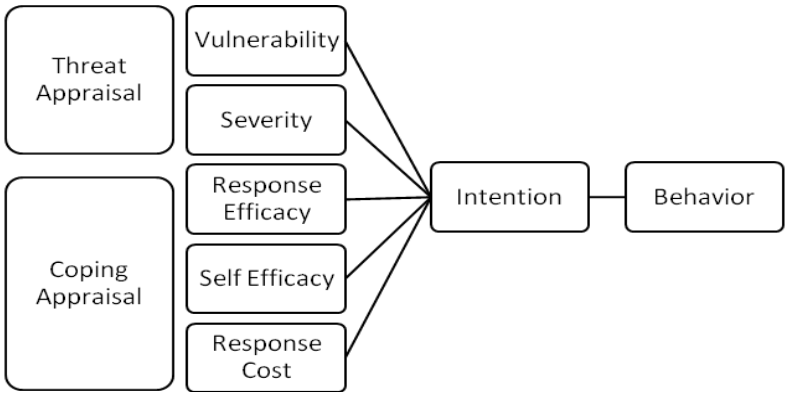

Figure 3 Conceptual Model of Protection Motivation Theory

Effects of PMT in Predicting Health-related Intention and Behavior

Two forms of research have been undertaken to test PMT: (a) PMT is used to predict health-related intentions and behaviors; or, (b) the main components of PMT are manipulated within persuasive communications to explore the effects of the intervention on subsequent beliefs, intentions, and behaviors.

Previous meta-analyses (Floyd, Prentice-Dunn, & Rogers, 2000; Milne, Sheeran, & Orbell, 2000) and reviews (Norman, Boer, & Seydel, 2005; Plotnikoff & Trinh, 2010) have summarized that PMT has been moderately effective in predicting health-related intentions and behaviors in various contexts. Specifically, previous studies and reviews have shown the modest support for the threat appraisal constructs and coping appraisal constructs of the PMT in predicting health-related intentions and behaviors, with coping appraisal constructs emerging as the strongest predictors (Floyd et al., 2000; Milne et al., 2000; Norman, Boer, & Seydel, 2005; Plotnikoff & Trinh, 2010). Sturges and Rogers (1996) included children and adolescents in their study. They looked at how children, adolescents, and adults reacted to the health threats related to smoking and their ability to cope by abstaining from smoking in a study. They concluded that the greatest levels of change in intention occurred when health threat and severity related to smoking were high, and self-efficacy and response efficacy to abstain from smoking were also high.

PMT has also been employed in the physical activity domain. Plotnikoff and Higginbotham (2002) found that the coping appraisal constructs had stronger positive associations with exercise intention than threat appraisal constructs. The threat appraisal (for heart disease) constructs had limited association with the exercise outcomes; fear was weakly associated with intention, whereas vulnerability was negatively associated with

intentions and behavior. In another study, Plotnikoff and Higginbotham (1998) indicated that self-efficacy was strongly associated with low-fat diet intentions and exercise intentions. Plotnikoff et al. (2009) examined the utility of PMT to predict physical activity behavior in a longitudinal study over two consecutive 6-month periods. The results showed that both self-efficacy and response efficacy were significantly associated with intention and behavior, self-efficacy and intentions significantly predicted subsequent physical activity behavior. Tulloch and colleagues (2009) examined the utility of PMT in the prediction of exercise intentions and behavior among cardiac patients and found that most of the PMT constructs (perceived severity, response efficacy, and self-efficacy) predicted exercise intentions, which, in turn predicted exercise behavior. However, the PMT model was not reliable for predicting exercise behaviors at 12 months after hospitalization. Similarly, Blanchard and associates (2009) tested PMT in explaining exercise intentions and behavior in cardiac patients receiving a home-based cardiac rehabilitation program. They concluded that threat appraisal constructs had limited motivational influence on exercise levels in home-based cardiac rehabilitation patients, whereas coping appraisal constructs were useful in explaining exercise behavior in this population. Finally a study by Plotnikoff et al. (2010) examined PMT in the context of diabetes management, and revealed that coping appraisal constructs significantly predicted intention and behavior in both type 1 diabetes and type 2 diabetes groups, with self-efficacy as the strongest predictor. Among threat appraisal constructs, only severity contributed significantly to the explanation of the variance in intention in the type 2 diabetes group, whereas vulnerability was not significantly related to intention or physical activity behavior. Self-efficacy and intention were significantly associated with physical activity behavior.

PMT-based Interventions to Promote Health Intention and Behaviors

Several PMT-based interventions have been conducted to promote health intentions and behaviors (Fry & Prentice-Dunn, 2006; McClendon & Prentice-Dunn, 2001; Milne et al., 2002; Schaffer & Tian, 2004; Zhang & Cooke, 2012). In these studies, the intervention group received information about a health threat and suggested preventive behaviors, whereas the control group received no such information. These studies found that PMT interventions significantly affected PMT constructs, but had limited effects on behavior.

Seven studies examined whether manipulating specific PMT constructs was effective to change cognitions of PMT constructs, intention, and behavior. Motivational essays or videos based on PMT constructs were provided as the interventions. These studies focused on the prevention of health threats through physical activity or exercise. Courneya and Hellsten (2001) found that there was a significant main effect for perceived severity and a significant interaction between perceived severity and response efficacy. Individuals who were led to believe that colon cancer was a severe disease (high PS) were more motivated to exercise if they also believed that exercise was effective (high RE) as opposed to ineffective (low RE) in reducing their risk of colon cancer. Stanley and Maddux (1986) conducted a study among 195 university students and reported that both self-efficacy and response efficacy were associated with participants' physical activity intention, with response efficacy being the strongest construct. However, results of another study conducted by Wurtele and Maddux (1987) among 160 university students revealed that both vulnerability and self-efficacy were associated with exercise intention and behavior. Fruin and his colleagues (1991) conducted a study with 615 adolescents and

found that participants in the high self-efficacy group showed stronger intentions to exercise, whereas those in the low self-efficacy group presented more endorsement of hopelessness and fatalism than did students in the high self-efficacy group. Graham et al. (2006) conducted a study with 173 teaching and school staff and found that persuasive message framing (presented in DVDs) was effective in manipulating participants' coping appraisal, which influenced their intentions to perform more exercise for colon cancer prevention, which, in turn, influenced their behavior to participate in exercise. Milne et al. (2002) conducted a study on PMT-based health education intervention to 248 undergraduate students and reported the intervention had a significant impact on cognitions of PMT constructs and exercise intentions but not on behavior in a 1-week follow-up. Zhang et al. (2012) also conducted a PMT-based health education intervention on undergraduate students. They also reported motivational intervention had significant positive effects on cognitions of PMT constructs and exercise intentions.

All of the previous seven interventions were successful in changing cognitions of PMT constructs. It was found that self-efficacy predicted intentions to exercise in all six studies, whereas five of them (Courneya & Hellsten, 2001; Graham, Prapavessis, & Cameron, 2006; Milne et al., 2002; Stanley & Maddux, 1986, Zhang & Cooke, 2012) found that perceived response efficacy also influenced intention to exercise. Perceived vulnerability to heart disease and stroke (Wurtele & Maddux, 1986) and perceived vulnerability to colon cancer (Courneya & Hellsten, 2001; Graham, Prapavessis, & Cameron, 2006) was also found to predict intentions to exercise. Courneya and Hellsten (2001) and Graham et al. (2006) reported the perceived severity construct predicted exercise intention significantly. Among all the threat and coping appraisal constructs, perceived

vulnerability was the only variable that predicted exercise behavior reported by Wurtele and Maddux (1987). These findings indicated that experimental manipulations are generally very effective in influencing subsequent cognitions and intention. However, as Milne et al. (2000) have illustrated in a review, the effectiveness of these experimental manipulations in influencing subsequent behavior is limited.

Among the aforementioned seven studies, four (Courneya & Hellsten, 2001; Fruin et al., 1991; Stanley & Maddux, 1986; Wurtele & Maddux, 1987) used some false information to manipulate the levels of certain PMT constructs (e.g., perceived severity, perceived vulnerability, response efficacy, and self-efficacy). It seemed difficult to apply such experimental manipulations to real-world intervention programs, because it is not generally practical or ethical in health education settings to provide participants with false information in order to manipulate the levels of a variable (e.g., to tell participants that heart disease is not a serious condition in order to produce 'low' perceived severity). Specifically, Courneya and Hellsten (2001) examined whether cancer prevention is a meaningful source of exercise motivation using PMT. In each persuasive communication used as intervention material, the key manipulations for each of the PMT constructs were as follows. For perceived vulnerability (PV), the manipulation was for risk, which was presented as either 1 in 200 (low PV) or 1 in 9 (high PV). For perceived severity (PS), colon cancer was characterized by either limited treatment problems plus an 80% five-year relative survival rate (low PS) or by major treatment problems (e.g., colostomy) plus a 20% five-year relative survival rate (high PS). For response efficacy (RE), the manipulation was the risk reduction associated with exercise, which was described as either 10% and inconsistent (low RE) or 60% and consistent (high RE). Self-efficacy was manipulat-

ed by describing the amount of exercise necessary to reduce colon cancer risk as either 5 to 6 days per week for 1 hour at high intensity (low SE) or as 2 to 3 days per week for 20 minutes at moderate intensity (high SE).

In a real-world health education intervention, the effects of providing factual information would be compared with a no information condition. The other three studies (Graham et al., 2006; Milne et al., 2002; Zhang et al., 2012) employed factual information to examine the effects of a PMT-based health education intervention on behavioral intentions. Specifically, in the study by Graham et al. (2006) one group received information regarding the susceptibility and severity of colon cancer, evidence linking colon cancer and exercise, and some common methods to help increase one's response efficacy and self-efficacy for engaging in more exercise and a control group received no information. This intervention improved early exercise behavior (2 weeks postintervention) but did not improve longer period exercise behavior (4 weeks postintervention). In the study conducted by Milne et al. (2002), participants in the experimental groups were asked to read a health education leaflet, which provided factual information about coronary heart disease and the benefits of exercise, and was based on PMT variables. Perceived severity was manipulated by outlining the painful and debilitating effects of CHD. Perceived vulnerability was manipulated using two statements to increase the belief that young adults who do not exercise are vulnerable to developing CHD in the future. Response efficacy was manipulated by explaining the effectiveness of exercise in preventing CHD. Self-efficacy was manipulated in two ways, first, by suggesting that it would be easy for participants to engage in exercise; second, by imagining oneself doing a few different exercises and finding one he/she was confident in trying. This motivational in-

tervention significantly increased threat and coping appraisal and intentions to engage in exercise but did not bring about a significant increase in subsequent exercise behavior. Zhang et al. (2012) tested the impact of combining a motivational intervention based on PMT plus a volitional intervention based on action planning and coping planning, as a way to promote the prevention of type 2 diabetes among UK undergraduates. The PMT-based intervention was a leaflet designed to target PMT constructs in relation to type 2 diabetes. For example, perceived severity was targeted by stating "If diabetes is not treated it can lead to many health problems." Self-efficacy was targeted by stating "Most young adults are able to stick to a healthy diet and engage in regular exercise." The motivational intervention significantly changed cognitions of PMT constructs, intention, and behavior. However, beyond the physical activity domain, Seydel and associates (1990) examined the effects of a PMT-based health education intervention employing factual information on subsequent behavior. They found that the PMT-based health education intervention had no effect on the behavior of ordering leaflets about cancer. Thus, further research is needed to seek the best ways of manipulating PMT variables within a factual health education intervention and to examine the effect of such a health education intervention on subsequent cognitions of PMT constructs, intention, and behavior.

In real-life health education settings, it is important to establish that the effects of an intervention last over a certain period of time. The success of the intervention reported by many previous studies tended to be measured immediately following the manipulation (Milne et al., 2002). Thus, cognitive change was measured when the information was still fresh in participants' minds (Wurtele & Maddux, 1987). Two studies included all PMT constructs in longitudinal health education intervention studies and measured the stability

of the effects of the interventions on subsequent changes in cognitions, intention, and behavior. Milne et al. (2002) found that the motivational intervention significantly increased threat and coping appraisal and intentions to engage in exercise, but did not bring about a significant increase in subsequent exercise behavior. They also found that all cognitive changes induced by the health education leaflet on PMT constructs and intention remained stable over the 2-week period. Results from a study by Graham et al. (2006) indicated that compared to the control group, the PMT intervention group scored significantly higher on response efficacy and intention to engage in more exercise. The intervention improved early exercise behavior (2 weeks postintervention), but did not improve longer period exercise behavior (4 weeks postintervention). Further study should be conducted to examine the effects of PMT-based intervention and combined PMT-based motivational and volitional intervention in 2-week and 4-week periods.

Implementation Intention

Origin of the Concept

Ajzen's (1991) theory of planned behavior is a model of the factors that motivate human behavior. Intention construct is central to the theory of planned behavior. Intention is conceptualized as a summary of the motivation required to engage in a particular behavior. This theory has been applied extensively and accounts for large proportions of the variance in health-related intentions and behaviors. For example, in a review from a database of 185 independent studies published up to the end of 1997, Armitage and Conner (2001) reported that the theory of planned behavior accounted for 27% and 39% of the variance in behavior and intention, respectively. Similar findings also emerged when

the theory of planned behavior was applied to physical activity. Hagger et al. (2007) showed that the theory of planned behavior was predictive of young people's physical activity intentions and subsequent physical activity behavior. Although large relationships between variables from the theory of planned behavior and subsequent behavior have been reported, there is still a large proportion of the variance unaccounted for (Armitage & Conner, 2001). Furthermore, Norman and Conner (1996) suggested that social cognitive models of health-related behavior are generally more successful at predicting intention than behavior.

In order to account for the apparent discrepancy between motivation and behavior, several researchers have argued that there are two stages (motivational and volitional) through which people pass before acting (Gollwitzer, 1993; Heckhausen, 1991). The motivational stage is concerned with increasing people's orientation toward enacting the behavior and culminates in the formation of a behavioral intention. The volitional stage culminates in the actual performance of the behavior in question (e.g., sedentary) and is important in translating motivational cognitions into action (Gollwitzer, 1993; Heckhausen, 1991). The motivational or deliberative phase parallels the view of intention formation offered by PMT. However, unlike PMT, a postintentional or volitional phase during which the individual develops strategies and plans to ensure the enacting of his/her intention has also been posited (Gollwitzer, 1993; Gollwitzer, Heckhausen, & Steller, 1990; Heckhausen, 1991). Thus, the model of action phases suggests that behavior is most likely when the individual is both motivated to act (motivational stage) and has developed strategies and plans that promote behavioral enactment (volitional stage).

Gollwitzer's (1993, 1999) concept of implementation intentions is an important volitional strategy to explore the ways in which motivation is translated into action.

Implementation Intention

According to Gollwitzer (1993, 1999), implementation intentions are volitional strategies that work independently of motivation by ensuring decisions are acted upon. Thus, whereas behavioral intentions influence the extent to which individuals are motivated to act, implementation intentions are regarded as an important way in which motivation is translated into action. Consistent with this idea, Armitage (2006) suggested that implementation intentions are only effective when people are at least somewhat motivated to act. Implementation intentions are if-then plans linking an anticipated situation to a goal-directed response. That is "If I encounter situation X, then I will perform behavior Y." Forming implementation intentions has been proposed as a potentially effective and inexpensive intervention (Gollwitzer, 1993, 1999). Implementation intentions are self-regulatory strategies and simply ask participants to plan when, where, and how they will exercise. For example, the thought of "I intend to exercise" (a goal intention) would result in the implementation intention of "I intend to go to the gym doing aerobics three times this week on my way from school" and behavior would be triggered by environmental cues such as "walking pass the gym" or "after school."

Implementation Intention Intervention

Gollwitzer (1993, 1996) posited that the formation of implementation intentions is a conscious process of cognitively pairing intended behavior with certain environmental cues. Thus, implementation intentions promote behavior because when meeting the speci-

fied conditions the environmental cues stimulate automatic activation of behavior. So, individuals will not miss the opportunity for action, even if it presents for only a fleeting moment. This view is supported by previous studies whose findings showed that participants are extremely likely to perform the behavior at the time and in the location they had previously specified in their implementation intentions (Orbell et al., 1997; Sheeran & Orbell, 1999).

There is now a large body of published experimental studies that have suggested implementation intention interventions are successful in changing a range of health behaviors, such as cancer screening behaviors, healthy eating, smoking cessation, binge drinking (Gollwitzer & Sheeran, 2006; Koestner, Lekes, Powers, & Chicoine, 2002; Sheeran, 2002), as well as physical activity (Armitage & Sorigg, 2010; Kwak, Kremers, Van Baak, & Brug, 2007; Luszczynska &Haynes, 2009; Prestwich, Perugini, & Hurling, 2010; Roberts, Maddison, Magnusson, & Prapavessis, 2010; Scholz, Knoll, Sniehotta, & Schwarzer, 2006; Sniehotta, Scholz, & Schwarzer, 2006). Milne et al. (2002) suggested implementation intentions used with the PMT-based interventions significantly increased exercise behavior over one week, while targeting the constructs of the PMT, whereas interventions without the use of implementation intentions did not. Zhang et al. (2012) also reported that the combined motivational and volitional intervention significantly decreased fat intake and increased the frequency of exercise relative to the motivational only and control groups. This indicated that combining PMT-based motivational intervention with implementation intention (a volitional strategy) intervention may be more effective than using PMT-based motivational interventions only. From a methodological perspective, implementation intention-based interventions offer advantages as follows

(Armitage & Sprigg, 2010). First, research into implementation intentions is characterized by studies that manipulate implementation intentions alone, meaning that implementation intentions are unambiguously causing behavior change. Second, implementation intentions are inexpensive and can be administered to large populations without first having to screen participants, and without having to target or tailor the materials.

As mentioned above, implementation intentions are self-regulatory strategies and simply ask participants to plan when, where, and how they will exercise. Researchers developed implementation intention interventions according to this format based on their own study settings. Milne et al. (2002) asked that participants read the following passage:

> Many people find that they intend to take at least one 20-minute session of vigorous exercise but then forget or 'never get around to it'. It has been found that if you form a definite plan of exactly when and where you will carry out an intended behavior you are more likely to actually do so and less likely to forget or find you don't get around to doing it. It would be useful for you to plan when and where you will exercise in the next week. (p. 170)

The participants were then asked to complete the following statements: "During next week I will partake in at least 20 minutes of vigorous exercise on (day or days)_____ at _____(time of day) at/or in (place)_____" (Milne et al., 2002, p. 170). The action plan form in the study by Zhang et al. (2012) started with the instruction:

> Exercise is known as physical activity and includes anything that gets you moving. Ideally you should take twenty minutes of vigorous exercise at least three times a week. Please think about when, where, and how you plan to be physically active. Please write down your exercise plans for next week using the form below. The more precisely, concretely and personally you formulate your plans, the more they will help you. (p. 218)

The form contained three rows headed Plan 1, Plan 2 and Plan 3, and four columns labeled 'Where', 'When', 'How', and 'With whom'.

Combining PMT-based Intervention with Volitional Intervention

Gollwitzer (1993, 1996) proposed that the formation of implementation intentions is to match intended behavior with certain environmental cues cognitively. Therefore, when individuals are at the specified environment, they will be automatically activated to do the intended behavior. Previous studies (Orbell et al., 1997; Sheeran & Orbell, 1999) supported this view. Results from these studies showed that participants are extremely likely to perform the behavior at the time and in the location they had previously specified in their implementation intentions. However, a goal intention alone is not sufficient to produce this effect (Gollwitzer, 1993; Gollwitzer & Brandstatter, 1997). Implementation intentions must be preceded by a goal intention. This is because implementation intentions work in the service of goal intentions (Gollwitzer, 1993). As discussed above, researchers have found that experimental manipulations to PMT variables are generally effective in influencing subsequent cognitions and intention. However, the influence of such experimental manipulations to subsequent behavior is limited and inconsistent (Floyd et al., 2000; Milne et al., 2000). Therefore, combining PMT-based motivational intervention with implementation intention (a volitional strategy) intervention may be more effective to promote health behaviors than using PMT-based motivational interventions or implementation intention intervention only.

Two studies have been conducted using a combined motivational and volitional intervention to promote physical activity behavior (Milne et al., 2002; Zhang et al., 2012). Milne et al. (2002) compared a motivational intervention which was based on PMT with the same motivational intervention augmented by a volitional intervention based on implementation intentions. They reported that the combined PMT intervention

with implementation intention intervention had a dramatic effect on subsequent exercise behavior. Zhang et al. (2012) tested the impact of combining a motivational intervention based on PMT plus a volitional intervention based on action planning and coping planning, as a way to promote the prevention of type 2 diabetes among UK undergraduates. The results showed that the combined motivational and volitional intervention significantly decreased fat intake and increased the frequency of exercise relative to all other groups, and significantly increased the amount of fruit and vegetables consumed relative to control and volitional intervention groups.

Summary

Although regular participation in physical activity has been widely accepted positively influencing individuals' health and well-being (Roberts & Barnard, 2005), a substantial number of adolescents are not sufficiently active (Biddle et al., 2004; Sallis, 2000). Thus, interventions designed to promote youth physical activity participation would be of considerable value. Adolescents in the United States have not escaped the obesity epidemic. Being overweight during childhood and adolescence increases the risk of many health problems (American Obesity Association, 2002; CDC, 2006; Krebs & Jacobson, 2003; Must & Strauss, 1999; Reilly et al., 2003). Obviously, obesity or overweight has been a health threat to adolescents.

Protection Motivation Theory (PMT; Rogers, 1983) has the potential to account for the cognitive mediation process and the major determinants of physical activity participation, particularly in the context of health-protective behaviors. The PMT was originally developed in 1975 by Ronald Rogers in an attempt to explain the mechanisms behind the attitudinal and behavioral change that individuals undertake when faced with a

real or perceived threat to their health (Rogers, 1975). Rogers (1983) proposed that persuasive communication, such as health warning messages stimulate two parallel appraisal processes: threat appraisal and coping appraisal. Threat appraisal consists of perceived vulnerability, perceived severity, and fear. Coping appraisal involves the main constructs of response efficacy, self-efficacy, and response costs. According to PMT, one's intention to adopt an adaptive response (protection motivation) or a maladaptive response (avoidance and denial) is a function of his/her threat appraisal and coping appraisal. Many studies have suggested that PMT has appeared to be useful in the prediction of and intervention implementation in health-related behaviors (Floyd et al., 2000; Milne et al., 2000; Plotnikoff & Trinh, 2010; Rogers, 1975, 1983). In the physical activity domain, consistent results have also been reported by previous studies (Courneya & Hellsten, 2001; Fruin et al., 1991; Graham et al., 2006; Milne et al., 2002; Plotnikoff et al., 2010; Plotnikoff & Higginbotham, 2002; 1998; Plotnikoff et al., 2009; Tulloch et al., 2009). However, as Milne et al. (2000) have illustrated in a review, the effectiveness of experimental manipulations to PMT constructs in influencing subsequent behavior is limited.

Previous studies (Graham et al., 2006; Milne et al., 2002) employed factual information to examine the effects of a PMT-based health education intervention on behavioral intentions. These motivational interventions significantly increased threat and coping appraisal and intentions to engage in exercise but did not bring about a significant increase in subsequent exercise behavior. Thus, further research is needed to seek the best ways of manipulating PMT constructs within a factual health education intervention and to examine the effect of such a health education intervention on subsequent PMT cognitions, intention, and behavior.

Social cognitive models of health-related behavior are generally more successful at predicting intention than behavior. In order to account for the apparent discrepancy between motivation and behavior, several researchers have argued that there are two stages (motivational and volitional) through which people pass before acting (Gollwitzer, 1993; Heckhausen, 1991). This suggests that a motivational model such as PMT could usefully be supplemented by volitional strategies in order to increase the likelihood of performing health behaviors.

Gollwitzer's (1993, 1999) concept of implementation intentions is an important volitional strategy to explore the ways in which motivation is translated into action. To date, numerous published experimental studies have suggested that implementation intention interventions are successful in changing a range of health behaviors, such as cancer screening behaviors, healthy eating, smoking cessation, binge drinking (Gollwitzer & Sheeran, 2006; Koestner, Lekes, Powers, & Chicoine, 2002; Sheeran, 2002), as well as physical activity (Armitage & Sorigg, 2010; Kwak, Kremers, Van Baak, & Brug, 2007; Luszczynska &Haynes, 2009; Prestwich, Perugini, & Hurling, 2010; Roberts, Maddison, Magnusson, & Prapavessis, 2010; Scholz, Knoll, Sniehotta, & Schwarzer, 2006; Sniehotta, Scholz, & Schwarzer, 2006).

CHAPTER 3

METHODS

This chapter specified who the participants were and how they were chosen. Methods of obtaining measurements were detailed. Next the research design and procedures were described. Finally, the planned statistical analyses of the data were explained.

Participants and Setting

The participating school was a suburban public school in the Mountain West Region of the United States. The school's total enrollment was 721 (375 boys, 346 girls). The grade distribution consisted of 245 seventh graders, 250 eighth graders, and 226 ninth graders. The racial and ethnic distribution consisted of 82.5% White (non-Hispanic), 10.1% Hispanic, 4.3% Asian or Pacific Islander, 1.7% Black, 1.4% American Indian or Native of Alaska. There were 412 seventh through ninth grade students enrolled in 12 physical education classes with class size ranging from 28 to 40 students. The study was designed to have 80% power to find a medium effect size (f = .20). Based on the results of an a priori power analysis using G Power 3.1 statistical software, the required total sample size was 236 participants. In the present study, 378 students agreed to participate in the study. The physical education classes in which the participants were enrolled were randomly assigned to one of the three groups. After deleting the drop-out

participants and data screening (reported in the data screening section), the final sample size was 330 (163 boys, 167 girls). Their age ranged from 11-15 years old (M_{age} = 13.39, *SD* = .97). Additional demographic information for groups was listed in Table 1.

Two experienced physical education teachers (one male and one female) taught the physical education classes. Seventh grade students had been introduced to a variety of sports. The emphasis in the physical education class was on moving and having fun. Eighth and ninth grade students continued to develop sports-related movement skills. Physical education classes during these grades focused on accruing physical activity, learning individual and team sport strategies and fostering teamwork.

Permission to conduct the study was obtained from the University Institutional Review Board, the Murray School District, the school administration, and the physical education teachers prior to the start of this study (see Appendix A to C). The students provided written informed assent and parents provided the written informed consent prior to participation in this study (see Appendix D).

Research Design and Procedures

During the week prior the intervention, the principal researcher explained the basic procedures, assent form, and parental information letter to students in their physical education classes. The students had an opportunity to ask any questions regarding the study and their possible participation in the study. Then, the students who were willing to participate in the study read and signed the assent form. Because the school's administrators did not allow the students to be randomly assigned to different groups individually, physical education classes were randomly allocated to one of the three groups.

Table 1

Demographic Distributions of Groups

			Grade			Race					Sex	
	N	Age	7th	8th	9th	White	African	Hispanic	Asian	Other	Male	Female
Group1	108	13.34±1.01	37	33	38	79	4	14	6	5	53	55
Group2	99	13.36±1.00	34	36	29	72	4	8	2	13	49	50
Group3	123	13.37±.91	43	47	33	95	4	9	2	13	61	62
Normal Weight	236	13.38±.97	83	86	67	178	7	21	7	23	121	115
Overweight/Obesity	94	13.43±.98	31	30	33	68	5	10	3	8	42	52
Total	330	13.39±.97	114	116	100	246	12	31	10	31	163	167

Note. Group1 = control group; Group 2 = motivational group; Group 3 = motivational + volitional group.

The study design was a repeated measure factorial design over a period of 5 weeks, involving a 1 week baseline measurement time period and three waves of data collection over a 4-week period following interventions (see Figure 4). Baseline measurements (the week prior to intervention) included participants' background, physical activity intention, self-reported physical activity behavior in the previous week, and in-class physical activity levels. Below are the details of the intervention schedule. At Time 1, participants in Group 2 and Group 3 received the motivational intervention by reading a health education leaflet, while Group 1 was asked to read the three opening paragraphs of a novel. Then, PMT constructs, physical activity intention, and in-class physical activity levels were measured among all the three groups. At Time 2, PMT constructs, physical activity intention, and in-class physical activity levels were measured again. Participants reported their physical activity behavior in the previous week. After completing the measurements, Group 3 received the implementation intention-based volitional intervention. Group 1 and Group 2 did nothing further. At Time 3, all participants completed the measures of PMT constructs, physical activity intention, self-reported physical activity behavior, and in-class physical activity levels. Group 1 received neither intervention. Group 2 (motivational intervention group) only received the motivational intervention. Group 3 (motivational intervention plus volitional intervention group) received both the motivational intervention and volitional intervention. The procedures are illustrated in Figure 4.

Students were taught how to wear an accelerometer by the principal researcher. All accelerometers were worn around the waist on the right side of the hip. The collection and return procedures of accelerometers were also clarified prior to data collection. Each

student was assigned an accelerometer number and wore that same accelerometer for all physical education classes. Signs were posted with student names and assigned accelerometer numbers on a display board. Accelerometers were placed on a numbered folder on the gym floor. The number on the accelerometer corresponded with the number on the folder. Prior to getting in their roll call lines, students put on their accelerometers. During the last 5 minutes of each class, students were instructed to place their accelerometers back on top of the folder with the same designated number as their accelerometers. At the completion of each data collection wave, the principal researcher downloaded the accelerometer data and checked that each accelerometer worked properly. All accelerometers were recharged and initialized one day before the data collection days.

Instrumentation

Demographics

Several demographic questions were used for this study. These questions included the participants' gender, age, grade, and race. The participants' height was measured by a Seca Stadiometer (Accurate to .1 cm, Seca Corp, CA) and weight was measured by a Taylor Digital Scale (Accurate to .1 kg, Model 7340B, Taylor Precision Products, Oak Brook, IL).

Intervention Materials

Motivational intervention materials. Two separate leaflets were produced for this study. The first one (see Appendix F) was designed to incorporate the five major constructs of PMT: perceived severity (PS), perceived vulnerability (PV), response

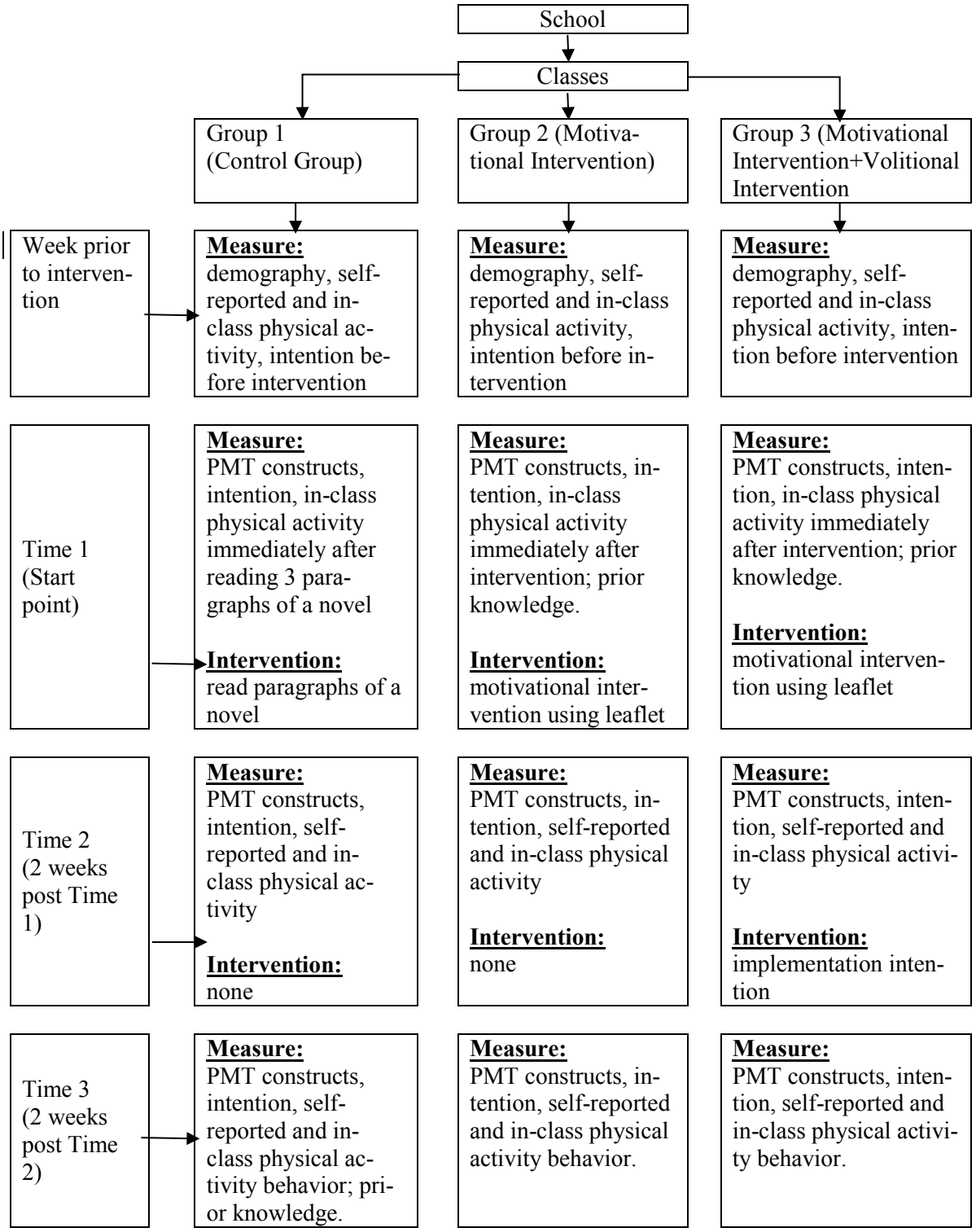

Figure 4. Research Procedures

efficacy (RE), self-efficacy (SE), and response costs (RC). This leaflet contained factual information about the prevalence and nature of overweight/obesity and the effects of physical activity on preventing this health threat. The content validity was confirmed by five health education specialists (two professors and three school health education teachers). All specialists agreed that the leaflet contained major relevant information and made minor revision to the leaflet. The manipulation to all the PMT constructs were modified from Milne et al. (2002) based on the situation in this study (Overweight/obesity as the health threat instead of coronary heart disease). Participants in both of the two experimental groups were told that: "The following passage presents a true account of the effect physical activity has on reducing the risk of overweight/obesity." The leaflet expanded on the following PMT constructs:

1. *Perceived severity* was manipulated by outlining the physical, psychological, and social consequences of overweight/obesity.
2. *Perceived vulnerability* was manipulated using statements to increase the belief that adolescents who do not participate in physical activity are very likely to develop overweight/obesity in the future.
3. *Response efficacy* was manipulated by explaining the effectiveness of physical activity in preventing overweight/obesity.
4. *Self-efficacy* was manipulated by suggesting that it would be easy for participants to engage in physical activity.
5. *Response costs* was manipulated by the statement: "Although adopting regular physical activity does have its costs, most adolescents find these to be very

minor and easily overcome and find that the benefits of regular physical activity far outweigh the costs."

A second leaflet was produced as an attention control condition. It was the opening paragraphs of a novel and was in similar length to the first leaflet (King, 2011).

Implementation intention intervention. The implementation intentions were developed based on previous studies (Gollwitzer, 1993; Gollwitzer & Brandstatter, 1997; Milne et al., 2002; Orbell et al., 1997). At first, participants received the following passage: "Many students find that they intend to take part in physical activity but then forget. It has been found that if you form a definite plan of exactly when and where you will carry out an intended action you are more likely to actually do so and less likely to forget or find you don't get round to doing it. It would be useful for you to plan when and where you will exercise in the next 2 weeks. Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, being active with friends, or walking to school. Examples of physical activity are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, football, and surfing." Then, they were asked to complete the following statements (see Appendix H): "During the next 2 weeks I will participate in at least 60 minutes of physical activity one day by ___(physical activity (-ies)_____ on_____(day or days)_____at_____(time of day) at/or in (place)_____."

Measures

PMT constructs and intention. Measures of PMT constructs and intention (see Appendix I; Milne et al., 2002) were employed and necessary modifications were made (obesity as the health threat instead of coronary heart disease) for this study. The PMT

constructs and intention measures were assessed on 5-point Likert scales, comprising belief statements coupled with appropriate response items. All the items were randomized so that patterns of questions were less obvious to the participants (Sheeran & Orbell, 1996). Perceived severity was measured by one item, namely, 'If I were to develop overweight/obesity I would suffer a lot of health problems (strongly disagree—strongly agree)'. Perceived vulnerability was measured by two items, such as, 'My chances of developing overweight/obesity in the future are (not at all strong—very strong)'. Response efficacy was measured by one item, namely, 'Participating in physical activity at least 60 minutes daily is a good way of reducing the risk of developing overweight/obesity (strongly disagree—strongly agree)'. Self-efficacy was measured by four items, such as, 'I feel confident in my ability to participate in physical activity at least 60 minutes daily in the next two weeks (strongly agree—strongly disagree)'. Response cost was measured by four items, such as, 'The benefits of taking physical activity for 60 minutes daily outweigh the costs (strongly agree—strongly disagree)'. Physical activity intention was measured by two items, such as, 'I do not wish to participate in physical activity at least 60 minutes daily in the next two weeks (strongly agree—strongly disagree)'. To score each construct, the scores for items that were reverse scored were first recoded. Then, the mean score for all items for each construct were calculated. All the PMT constructs and intention that were measured by multiple items formed reliable scales, with Cronbach's α values ranging from .73 to .95 (Milne et al., 2002).

Physical activity levels. Self-reported physical activity behavior has been previously shown to be reliable and correlated with accelerometer data in adolescents (Prochaska, Sallis, & Long, 2001). A two-item overall physical activity questionnaire (see

Appendix J; Durant et al., 2008) was employed in this study. Participants were asked, 'How many days in a typical week were you physically active for at least 60 minutes?' and 'How many days in the past week were you physically active for at least 60 minutes?' These two items were averaged to obtain a measure of moderate to vigorous physical activity. Moderate reliability (ICC= .61) has been demonstrated in adolescents aged 12-18 years who attended schools outside of their home (Durant et al., 2008).

In addition, students' in-class physical activity levels were measured using Acti-Graph GT1M accelerometers (Pensacola, FL). This model of accelerometers measured 5.3 × 5.0 × 2.0 cm and were worn on a waistband or in a clip pouch at the midaxillary line of either hip. Accelerations were converted into activity counts, which increased linearly with the magnitude of accelerations. Activity counts were summed and recorded for a user-specified epoch ranging from 5s to 1 min. The sum of activity counts in an epoch is linearly related to activity intensity and can be classified into activity intensities based on established cut points. More recently, researchers demonstrated acceptable validity and reliability of the ActiGraph GT1M when used with adolescents (e.g., Corder et al., 2007). Given the short duration of the physical education class and the aims of this study, activity counts were measured in 5s epochs, and in-class physical activity levels were quantified as percentage of time spent in activity intensities. Cut points established by Freedson and colleagues (2005) were applied to the data: (a) 0–149 counts = sedentary; (b) 150–499 counts = light; and, (c) 500-3999 counts = moderate; (d) 4000-7599 counts = vigorous; (e) >7600 counts = very vigorous physical activity. In this study, students' percentage of time spent in MVPA was used as the outcome variable.

Body weight category. Body mass index (BMI), which is calculated as weight in kilograms divided by height in meters squared, is a measure used to determine childhood overweight and obesity in large scale studies. BMI does not measure body fat directly, but it is a reasonable indicator of body fatness for most children and adolescents. A child's or adolescent's weight status was determined using an age- and sex-specific percentile for BMI rather than the BMI categories used for adults, because children and adolescents' body composition varies as they age and varies between boys and girls. CDC Growth Charts (CDC, 2011) were used to determine the corresponding BMI-for-age and sex percentile. For children and adolescents (aged 2-19 years): Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children or adolescents of the same age and sex; Obesity is defined as a BMI at or above the 95th percentile for children or adolescents of the same age and sex. Table 2 lists the CDC cut-off points for BMI for overweight and obesity by gender between 11 and 15 years. Participants' body weight and height were measured to calculate their BMI and determine body weight category.

Data Analysis

SPSS 18.0 Missing Values Analysis was used to highlight the patterns of missing values as well as replace them in the data set. Descriptive statistics procedure was run to identify univariate outliers. The multivariate outliers were identified using Mahalanobis distance. Descriptive statistics (means and standard deviations) were calculated for each variable. A one-way ANOVA was used to check whether there were significant differences among the three groups in terms of previous physical activity level, intention, and demographics prior to the study. Similarly, the differences in intention or any of the

Table 2

CDC BMI Cut-off Points for Overweight/Obesity by Gender Between 11 and 15 Years

	Underweight		Overweight		Obesity	
Age	Boys	Girls	Boys	Girls	Boys	Girls
11	14.5	14.3	20.2	20.8	23.2	24.2
12	15.0	14.8	21.0	21.7	24.2	25.2
13	15.4	15.3	21.8	22.5	25.2	26.2
14	16.0	15.8	22.6	23.3	26.0	27.2
15	16.5	16.3	23.4	24.0	26.8	28.1

PMT constructs between Group 2 and Group 3 were also examined to determine whether the volitional intervention was confounded by the differences on intentions or the variables influencing intentions. In order to check whether the interventions differentially impacted adolescents who were more and less active at baseline, cluster analysis was first conducted on participants' self-reported physical activity levels to determine more active participants and less active participants. Then, 3 (intervention) × 3 (time) MANOVA was conducted to more active participants and less active participant separately.

To explore the effects of the interventions, over time, on PMT constructs, physical activity intention, and physical activity behavior as well as to examine the differences on perceptions of PMT constructs, physical activity intention, and physical activity behavior, a 3 (intervention) × 2 (body weight) × 3 (time) mixed model MANOVA with two between-subjects factors (three levels of interventions: control, motivational intervention, motivational plus volitional intervention; two levels of body weight: overweight/obesity

vs. normal) and one within-subjects factor (three levels: Time 1, Time 2, Time 3) was used to test the main effects of intervention condition, time, and body weight and the interactions of intervention × time, body weight × time, intervention × body weight, and intervention × body weight × time. Follow-up univariate tests would be conducted if the MANOVA were significant.

A correlation matrix was produced in order to determine zero-order relationships between each PMT construct, physical activity intention, and physical activity behavior. The strength and direction of a linear relationship between any two above-mentioned variables without controlling any other variables would be confirmed. To test PMT's predictive ability on physical activity intention and physical activity behavior, two hierarchical regression analyses with forced entry were employed. Time 1 cognitions of PMT constructs and physical activity intention were measured immediately after PMT-based motivational intervention. Time 2 physical activity behavior was measured after the intervention. Thus, Time 1 cognitions of PMT constructs and physical activity intention were used to predict Time 2 physical activity behavior; and Time 1 cognitions of PMT constructs were used to predict Time 1 physical activity intention. To determine the association of the PMT constructs and physical activity intention with physical activity behavior in the first analysis, intention was regressed onto physical activity behavior in Block 1; and then self-efficacy, response efficacy, response costs, perceived severity, and perceived vulnerability were regressed onto behavior in Block 2. In order to determine whether the weight category moderated the relationships between PMT constructs and physical activity behavior, weight category × self-efficacy, weight category × response efficacy, weight category × response cost, weight category × severity, and weight catego-

ry × vulnerability were entered in Block 3. Next, the second hierarchical regression analysis was used to determine the association of the PMT constructs with physical activity intentions. Self-efficacy, response efficacy, response costs, perceived severity, and perceived vulnerability were entered in Block 1. Weight category × self-efficacy, weight category × response efficacy, weight category × response cost, weight category × severity, and weight category × vulnerability were entered in Block 2.

CHAPTER 4

RESULTS

The study's findings were presented in this chapter. Specifically, the results were addressed by the order of data screening, descriptive statistics, effects of interventions on PMT constructs and intention, effects of interventions on physical activity behavior, and body weight group differences of PMT constructs, intention, and behavior.

Data Entry and Screening

At the beginning, 378 students were recruited to participate in this study. Because 2 participants transferred to other schools and 4 participants withdrew from the research process, 372 participants went through the whole research process. All of the data from self-reported questionnaires were entered into an Excel file. Data from the accelerometers was downloaded according to manufacturer's instructions using ActiLife Lifestyle Monitoring Software (Version 6.2.0, Actigraph, LLC., Pensacola, FL) and exported into an AGD file at the end of each data collection date. Each accelerometer potentially included data for 6 participants (6 physical education units each day). The principal researcher then downloaded the data to an ActiLife AGD file for each accelerometer. Once this process was completed for all students, the principal researcher calculated the percentage of time spent in each activity category (sedentary, light PA, and MVPA) by the Data Scoring Tool provided with the ActiLife Lifestyle Monitoring Software, and

then exported the results to the Excel file. Once it was completed, each participant's accelerometer data along with self-reported data were put into one excel file and imported into the SPSS 18.0 statistics program.

Prior to statistical analysis, data from each time-point for perceived severity, perceived vulnerability, response efficacy, self-efficacy, response cost, intention, self-reported physical activity behavior, in-class physical activity levels, and height and weight were examined through various SPSS programs for accuracy of data entry and missing values. The variables were examined separately for the control group, motivational intervention group, and motivational plus volitional intervention group.

To ensure reliable data entry, the SPSS program frequency was run to visually check for inconsistent values. Inaccuracies were not detected in the frequencies output. The missing values in this study were first identified by scanning the data set visually, and then by assessing the output of frequencies. SPSS 18.0 MVA (Missing Values Analysis) was specifically used to highlight patterns of missing values as well as replace them in the data set. The percent of missing value for each variable ranged from 0% to 21.5 % and missing at random was inferred from the MVA. Thus, the missing values were imputed by expectation maximization.

To identify any potential univariate outliers in the data set, first, visual inspection and frequency distributions were applied to identify the scores that appeared far from the other scores. Second, box and whisker plots, and stem-and-leaf diagrams were utilized to identify scores that appeared unattached to the bulk of the distribution. Cell values above a Z-score of 3.29 were deleted (Tabachnick & Fidell, 2007) as univariate outlier. A total of 35 cases were identified and deleted as univariate outliers following these strategies,

leaving 337 cases. Additionally, seven other cases were identified through Mahalanobis distance as multivariate outliers with $p < .001$. After removing 7 multivariate outliers, the final sample for analysis was 330 cases.

Randomization Checks and Descriptive Analysis

A one-way ANOVA was conducted to test for any potential differences between the three groups before implementing the interventions. The results of the test revealed that there were no significant differences between the three groups in terms of previous self-reported physical activity behavior ($F(2, 327) = 1.14$, $p > .05$), previous intention for physical activity ($F(2, 327) = 2.33$, $p > .05$), participants' height ($F(2, 327) = .20$, $p > .05$), participants' weight ($F(2, 327) = 2.51$, $p > .05$), and participants' age ($F(2, 327) = .18$, $p > .05$). However, there was a significant difference ($F(2, 327) = 12.59$, $p < .01$) between groups on in-class physical activity levels. Therefore, the dependent variable of in-class physical activity levels was omitted from this study. There was no significant difference in gender ($\chi^2(2) = .01$, $p > .05$) either.

Means and standard deviations of all variables for all groups at each time point are presented in Table 3. Overall, the participants strongly agreed that overweight or obesity would lead to a lot of health problems, participating in physical activity at least 60 minutes a day was a good way of reducing the risk of developing overweight/obesity, and they felt confident to participate in physical activity. The participants did not feel very vulnerable to develop overweight/obesity in the future and they also felt that the benefits of physical activity outweighed the costs. The values for physical activity intention showed that the participants had high intention to participate in physical activities. As to physical activity behaviors, the means suggested that the participants

Table 3

Descriptive Statistics for Groups Over Each Time Point

Variable	Time	Control	Motivation	Motivation+ Volition	Normal Weight	Overweight/ Obesity
	T	N = 108 M(SD)	N = 99 M(SD)	N = 123 M(SD)	N = 236 M(SD)	N = 94 M(SD)
Perceived severity	T1	4.32(1.01)	4.33(.80)	4.50(.73)	4.45(.84)	4.24(.87)
	T2	4.16(1.12)	4.30(1.03)	4.26(1.01)	4.23(1.11)	4.28(.91)
	T3	4.33(.99)	4.17(1.18)	4.34(1.09)	4.28(1.14)	4.30(.97)
Perceived vulnerability	T1	1.95(.88)	2.20(.99)	2.19(1.00)	1.86(.86)	2.75(.92)
	T2	1.93(.90)	2.08(.95)	2.13(.96)	1.82(.88)	2.62(.83)
	T3	1.95(.98)	2.11(1.02)	2.07(.91)	1.80(.91)	2.63(.84)
Response efficacy	T1	4.54(.87)	4.66(.62)	4.66(.59)	4.68(.68)	4.48(.73)
	T2	4.72(.61)	4.61(.71)	4.72(.53)	4.71(.61)	4.63(.63)
	T3	4.55(.72)	4.39(1.02)	4.43(.97)	4.48(.95)	4.42(.82)
Self-efficacy	T1	3.71(.96)	3.81(.86)	3.88(.82)	3.85(.89)	3.69(.84)
	T2	3.90(.89)	3.79(.85)	3.96(.85)	3.97(.88)	3.68(.80)
	T3	3.95(.93)	3.95(.92)	3.95(.82)	4.03(.90)	3.74(.80)
Response cost	T1	2.06(.75)	1.93(.76)	1.90(.78)	1.90(.75)	2.12(.78)
	T2	1.91(.75)	2.00(.85)	1.72(.66)	1.80(.77)	2.02(.70)
	T3	1.89(.85)	1.99(.91)	1.84(.75)	1.81(.80)	2.13(.87)
Intention	T1	4.14(.93)	4.04(1.06)	4.09(.96)	4.18(.96)	3.82(.99)
	T2	4.35(.81)	4.02(.94)	4.25(.85)	4.26(.88)	4.10(.85)
	T3	4.21(.94)	4.06(1.03)	4.15(.88)	4.24(.95)	3.93(.86)
PA behavior	T1	4.38(1.62)	4.63(1.56)	4.31(1.60)	4.61(1.53)	3.98(1.67)
	T2	4.74(1.49)	5.00(1.29)	4.63(1.42)	4.93(1.31)	4.40(1.57)
	T3	4.81(1.52)	4.93(1.24)	4.81(1.52)	5.02(1.37)	4.41(1.52)

were physically active for at least 60 minutes per day for more than 4 days every week.

Participants were classified into more active group and less active group by cluster analysis on participants' prior intervention self-reported physical activity levels. The more active group included 185 adolescents (103 boys, 82 girls) between the ages of 11 and 15 years old (M_{age} = 13.4, SD = 1.0). The less active group included 145 adolescents (60 boys, 85 girls) between the ages of 11 and 15 years old (M_{age} = 13.4, SD = 1.0). The results of 3 (intervention) × 3 (time) MANOVA to more active group indicated a nonsignificant main effect for intervention on cognitions of PMT constructs, physical activity intention, and physical activity behavior (Wilk's lambda = .89, $F(14, 352) = 1.58$, $p > .05$, $\eta^2 = .06$) and for the condition × time interaction (Wilk's lambda = .83, $F(28, 338) = 1.20$, $p > .05$, $\eta^2 = .09$). MANOVA revealed a main effect for time (Wilk's lambda = .86, $F(14, 169) = 2.05$, $p < .05$, $\eta^2 = .15$). The intervention was not effective to more active adolescents. Whereas, the results of 3 (intervention) × 3 (time) MANOVA to less active group indicated a statistically significant main effect for intervention on cognitions of PMT constructs, physical activity intention, and physical activity behavior (Wilk's lambda = .80, $F(14, 272) = 2.36$, $p < .01$, $\eta^2 = .11$) and for time (Wilk's lambda = .44, $F(14, 129) = 11.88$, $p < .01$, $\eta^2 = .56$). MANOVA revealed a non significant effect for the condition × time interaction (Wilk's lambda = .76, $F(28, 258) = 1.33$, $p > .05$, $\eta^2 = .13$). The further pairwise comparison showed the difference only existed between Group 2 and Group 3 on the PMT construct of perceived severity ($p < .05$). Because, Group 2 and Group 3 received the same PMT-based motivational intervention, the difference between Group 2 and Group 3 on perceived severity was not due to intervention. The intervention was also not effective to less active adolescents.

Effects of Interventions on PMT Constructs and Intention

The main research hypotheses were tested by conducting a mixed model MANOVA with two between-subject factors (3 levels of intervention conditions: control, motivational intervention, motivational plus volitional intervention; 2 levels of weight conditions: normal weight, overweight/obesity) and one within-subjects factor (3 levels: Time 1, Time 2, Time 3). MANOVA yielded a nonsignificant main effect for intervention condition on PMT constructs and intention (Wilk's lambda = .94, $F(12, 638) = 1.54$, $p > .05$, $\eta^2 = .03$), the condition × time interaction (Wilk's lambda = .90, $F(24, 626) = 1.35$, $p > .05$, $\eta^2 = .05$), the condition × time × weight category interaction (Wilk's lambda = .90, $F(24, 626) = 1.41$, $p > .05$, $\eta^2 = .05$), and the time × weight category (Wilk's lambda = .96, $F(12, 313) = 1.15$, $p > .05$, $\eta^2 = .04$). MANOVA revealed a main effect for time (Wilk's lambda = .87, $F(12, 312) = 4.05$, $p < .001$, $\eta^2 = .13$). However, because the interaction of condition × time was not statistically significant, the changes of the PMT constructs and physical activity intention over time were parallel between groups. Therefore, this time effect was not produced by the intervention. The results suggested that the motivational intervention did not successfully impact the PMT constructs and physical activity intention. The hypotheses a and b for purpose 1 were not supported by the results. The third hypothesis that the effect of the motivational intervention on PMT constructs, physical activity intention would remain stable over the 4 weeks of the study process was not tested because of the nonsignificant main effect for intervention condition.

Effects of Interventions on Physical Activity Behavior

The results of the mixed model MANOVA with repeated measures revealed a non significant main effect for intervention condition on participants' self-reported physical activity behavior ($F(2, 324) = 2.36$, $p > .05$, $\eta^2 = .02$) as well as the condition × time interaction (Wilk's lambda = .99, $F(4, 646) = .63$, $p > .05$, $\eta^2 = .01$). MANOVA revealed a significant main effect for time (Wilk's lambda = .93, $F(2, 323) = 12.72$, $p < .001$, $\eta^2 = .07$). Similar to the above section, because the interaction of condition × time was not statistically significant, the changes of physical activity behavior over time were parallel between groups. Therefore, this time effect was not produced by the intervention. The findings suggested that the interventions did not promote the participants' physical activity behavior and the hypothesis for purpose 2 was not supported. The addition of an implementation intention intervention to the PMT-based motivational intervention did not increase adolescents' participation in at least 60 minutes of physical activity per day over the 2 weeks after the intervention compared to the conditions without any interventions and with the motivational intervention only.

Body Weight Group Differences of PMT

Constructs, Intention, and Behavior

The MANOVA showed a significant effect for body weight categories on cognitions of PMT constructs and intentions (Wilk's lambda = .78, $F(6, 318) = 14.76$, $p<.01$, $\eta^2 = .22$), and self-reported physical activity behaviors ($F(1, 324) = 17.71$, $p < .01$, $\eta^2 = .05$). Follow-up tests revealed that there were statistically significant differences between overweight/obese participants and normal weight participants on perceived vulnerability, self-efficacy, response costs, intention, and self-reported physical activity behavior (Ta-

ble 4). Overweight/obese participants reported higher perceived vulnerability and response cost than normal weight participants did. They also reported significantly lower self-efficacy, intention, and physical activity behavior. The findings partially support the hypotheses for purpose 3. Specifically, overweight/obese adolescents rated their personal beliefs about the severity of the threat and personal vulnerability to the threat of obesity as higher than normal weight adolescents, although only personal vulnerability was statistically different. Second, overweight/obese adolescents rated their personal self-efficacy and response efficacy lower than normal weight adolescents, but only self-efficacy was statistically lower.

Table 4

PMT Constructs, Intention and Behavior Means Across Body Weight Groups

Variable	Normal Weight *M(SD)*	Overweight & Obesity *M(SD)*	F	*p*	η^2
Perceived severity	4.32(.05)	4.22(.09)	.837	.364	.003
Perceived vulnerability	1.83(.05)**	2.67(.08)**	87.97	.000	.214
Response efficacy	4.62(.04)	4.51(.06)	2.34	.127	.007
Self-efficacy	3.95(.05)**	3.68(.07)**	9.32	.002	.028
Response costs	1.85(.04)**	2.10(.07)**	9.37	.002	.028
Intention	4.22(.05)**	3.96(.08)**	7.68	.006	.023
Behavior	4.86(.08)**	4.21(.13)**	17.71	.000	.052

Note. ** significant difference between groups at $p < .01$

Associations Between PMT Constructs, Intentions, and Behavior

To test the associations between PMT constructs, physical activity intention, and physical activity behaviors, the measures of PMT constructs measured at Time 1 for both intervention groups (They received PMT-based motivational intervention at the same time, i.e., they were in the same condition.) were included in a regression analysis. Be-

cause the PMT constructs and intention measured at Time 1 were used to predict self-reported physical activity behavior at Time 2, self-reported physical activity behavior measured at Time 2 was used in the regression analysis. The sample (the 2 intervention groups) for regression analysis included 222 adolescents (110 boys, 112 girls) between the ages of 12 and 15 years old. The mean age of the participants was 13.4 years old (*SD* = .95), and the sample consisted of 34.7% seventh grade, 37.4% eighth grade, and 27.9% ninth grade students. Ethnic backgrounds of the participants were 75.2% White American, 7.7% Hispanic American, 3.6% African American, 1.8% Asian American, and 11.7% others.

Correlations among each of the variables are presented in Table 5. Intention (r = .23, $p < .01$), self-efficacy (r = .24, $p < .01$), response efficacy (r = .18, $p < .01$), response costs (r = -.28, $p < .01$), and perceived vulnerability (r = -.23, $p < .01$) were significantly correlated with physical activity behavior. Additionally, self-efficacy (r = .52, $p < .01$), response efficacy (r = .20, $p < .01$), response cost (r = -.57, $p < .01$), and perceived vulnerability (r = -.14, $p < .05$) were significantly correlated with physical activity intention.

Table 5

Descriptive statistics and correlations among PMT constructs, intention, and behavior

	2	3	4	5	6	7	*Mean*	*SD*
1. Physical activity	.23**	.24**	.18**	-.28**	-.05	-.23**	4.80	1.37
2. Intention		.52**	.20**	-.57**	.06	-.14*	4.07	1.01
3. Self-efficacy			.18**	-.51**	.09	-.24**	3.85	.84
4. Response efficacy				-.20**	.13*	-.09	4.66	.60
5. Response cost					-.13*	.13*	1.91	.77
6. Severity						.06	4.43	.76
7. Vulnerability							2.19	.99

Notes. *$p < .05$; **$p < .01$

To predict physical activity behavior, the results of the hierarchical regression analysis revealed that the entire PMT model accounted for 14% of variance, with intention accounting for 6% ($F(1, 220) = 12.45$, $R^2 = .06$, $p < .01$ for model 1 of predicting behavior) and PMT constructs account for 8% ($F(5, 215) = 4.20$, $R^2 = .14$, $p < .01$ for model 2 of predicting behavior; Table 6). Specifically, in Block 1, intention was a significant predictor of physical activity behavior ($\beta = .23$ $p < .01$). In Block 2, the PMT constructs of response costs ($\beta = -.18$, $p < .05$) and perceived vulnerability ($\beta = -.16$, $p < .05$) were the significant predictors of physical activity behavior. The weight category as moderator in the relation between PMT constructs and physical activity behavior in Block 3 were not statistically significant ($F(5,210) = 1.81$, $R^2_{change} = .03$, $p > .05$).

In terms of physical activity intention, regression analysis revealed that the PMT constructs ($F(5, 216) = 28.35$, $R^2 = .40$, $p < .01$ for model 1 for predicting intention) accounted for 40% of the variance in physical activity intention (Table 7). Specifically in Block 1, self-efficacy ($\beta = .30$, $p < .01$) and response costs ($\beta = -.40$, $p < .01$) were significant predictors of physical activity intention. The weight category as moderator in the relation between PMT constructs and physical activity intention in Block 2 were not statistically significant ($F(5,211) = 1.96$, $R^2_{change} = .03$, $p > .05$).

Table 6

Models predicting physical activity behavior

	F_{change}	R^2	R^2_{change}	B^1	B^2	B^3	β^1	β^2	β^3
(Block 1)	12.45**	.06	.06						
Intention				.32**	.08	.05	.23**	.06	.03
(Block 2)	4.20**	.14	.08						
Self-efficacy					.11	-.01		.07	-.00
Response efficacy					.26	-.26		.11	-.11
Response cost					-.31*	-.34*		-.18*	-.20*
Severity					-.15	.04		-.08	-02
Vulnerability					-.22*	-.30*		-.16*	-.22*
(Block 3)	1.81	.17	.03						
Weight Category × Self-efficacy						.54			.72
Weight Category × Response efficacy						-.10			.15
Weight Category × Response cost						.09			.07
Weight Category × Severity						-.55			-.84
Weight Category × Vulnerability						-.20			.20

Notes. $B^{1\text{-}3}$ and $\beta^{1\text{-}3}$= unstandardized and standardized regression coefficients for model 1-3

*$p < .05$; **$p < .01$

Table 7

Models predicting physical activity intention

	F_{change}	R^2	R^2_{change}	B^1	B^2	β^1	β^2
(Block 1)	28.35**	.40	.40				
Self-efficacy				.37**	.31**	.30**	.25**
Response efficacy				.11	.29*	.07	.17*
Response costs				-.52**	-.56**	-.40**	-.43**
Severity				-.04	-.05	-.03	-.03
Vulnerability				-.00	-.05	-.00	-.05
(Block 2)	1.96	.42	.02				
Weight Category × Self-efficacy					.28		.51
Weight Category × Response efficacy					-.42		-.90
Weight Category × Response cost					.14		.14
Weight Category × Severity					.01		.02
Weight Category × Vulnerability					.17		.24

Notes. $B^{1\text{-}2}$ and $\beta^{1\text{-}2}$= unstandardized and standardized regression coefficients for model 1and model 2

*$p < .05$; **$p < .01$

CHAPTER 5

DISCUSSION

The primary purpose of the study was to investigate the effect of a PMT-based motivational intervention on subsequent changes in cognitions of PMT constructs, physical activity intention, and behavior among adolescents. The second purpose was to examine whether combining PMT-based motivational intervention with an implementation intention intervention would improve the likelihood of adopting physical activity behavior. The present study also examined the differences on adolescents' cognitions of PMT constructs, physical activity intention, and physical activity behavior between overweight/obese adolescents and normal weight adolescents. Lastly, this study examined the predictive strengths of PMT constructs on physical activity intention and physical activity behavior among adolescents.

With regard to the first two purposes, the results indicated that the PMT-based motivational intervention did not significantly change participants' cognitions of PMT constructs, physical activity intention, and physical activity behavior. The intervention combining PMT-based motivational intervention with implementation intention-based volitional intervention did not significantly promote adolescents' physical activity behavior either. In terms of the differences in cognitions of PMT constructs between overweight/obese adolescents and normal weight adolescents, the results revealed that there were significant differences between overweight/obese participants and normal weight

participants on perceived vulnerability, self-efficacy, response costs, intention, and self-reported physical activity behavior. Overweight/obese participants reported higher perceived vulnerability and response costs than normal weight participants did. They also reported significantly lower self-efficacy, intention, and physical activity behavior. Regarding the utility of PMT constructs and physical activity intention as predictors of physical activity behavior, the results suggested that the PMT constructs of response costs, perceived vulnerability, and intention were the significant predictors of physical activity behavior. Physical activity intention was significantly predicted by the PMT constructs of self-efficacy and response costs.

Effects of Interventions on PMT Constructs and Intention

The results revealed no significant effects for the PMT-based motivational intervention in terms of changing cognitions represented by PMT constructs or changing intention to physical activity. Therefore, the hypotheses that the motivational intervention (persuasive communication) would increase perceptions of perceived self-efficacy, response efficacy, perceived severity, perceived vulnerability, and reduce response costs compared to the condition without the motivational intervention, and that the motivational intervention would increase intention to engage in at least 60 minutes of physical activity per day over the following 2 weeks after intervention compared to the condition without the motivational intervention were not supported. The results are inconsistent with Milne et al. (2002) and Zhang et al. (2012). Milne et al. (2002) conducted a study on PMT-based health education intervention to 248 undergraduate students and reported the intervention had a significant impact on cognitions of PMT constructs and exercise intentions but not on behavior in a 1-week follow-up. Zhang et al. (2012) also conducted a

PMT-based health education intervention to undergraduate students. They also reported the motivational intervention had significant positive effect on cognitions of PMT constructs and exercise intentions.

There are several potential reasons for the inconsistency. First, this is the first study to use overweight/obesity as a health threat in application of PMT. Previous studies used colon cancer (Courneya & Hellsten, 2001; Graham et al., 2006), coronary heart disease (Milne et al., 2002), and diabetes (Zhang et al., 2012) as the health threat source for the intervention. This factor might have influenced the effects of a motivational intervention on PMT constructs and intention. PMT proposed if a communication of health threat information evokes fear, then the recipient will be motivated to reduce this unpleasant emotional state. Overweight/obesity might not evoke enough fear as the diseases (e.g., colon cancer, coronary heart disease, and diabetes) did in previous studies. Comparing the means of the PMT constructs in this study to those of previous studies, the participants in the present study perceived lower vulnerability than those in previous studies did. Means of perceived vulnerability to overweight or obesity of each group at different time-points ranged from 1.95 to 2.20 (39% to 44% on the 5-point scale) in this study. However, participants in the study conducted by Graham et al. (2006) reported the perceived vulnerability to colon cancer from 3.53 to 4.32 (50% to 62% on a 7-point scale). In the study conducted by Milne et al. (2002), participants' perceived vulnerability to coronary heart disease of each group at every time-point ranged from 3.86 to 4.44 (55% to 63% on a 7-point scale). Zhang et al. (2012) reported that participants' perception of vulnerability to diabetes of each group at each time-point ranged from 2.43 to 3.91 (49% to 78% on a 5-point scale). The PMT hypothesized that the intention to protect oneself

from danger is a function of four cognitive beliefs: (a) the threat is severe; (b) one is personally vulnerable to the threat; (c) the coping response is effective in averting the threat; and (d) one has the ability to perform the coping response (Plotnikoff & Trinh, 2010). The relatively lower perceived vulnerability in this study suggested participants in the study did not feel strongly that they were personally vulnerable to the threat of overweight/obesity. Therefore, their physical activity intention was relatively lower, which partially explained the nonsignificant effect of the motivational intervention on physical activity intention. Second, previous studies recruited college students (Mile et al., 2002; Zhang et al., 2012), physically inactive teaching and school staff (Graham et al., 2006), and adults between the ages of 18 and 65 years (Plotnikoff et al., 2009). One study (Fruin et al., 1991) recruited 9th and 10th grade high school students. However, participants in this study were 7th to 9th grade junior high school students (11 to 15 years old). According to Piaget's theory of cognitive development (Bjorklund, 2004), children's thinking is oriented to things and events that they can observe directly, whereas adolescents can think hypothetically. Participants in the present study are at the change point from childhood to adolescence. Thus, the limitation of abstract thinking may become a hindrance to the cognitions of health threat and intention. Third, participants' prior knowledge about the intervention materials might be another factor leading to the nonsignificant effects of interventions. After reading the leaflet serving as the PMT-based motivational intervention material, participants were asked to rate their mastery of information on the leaflet. The information included the prevalence and nature of overweight or obesity, and the effects of physical activity on preventing this health threat. The mean was 3.51 (5-point scale), standard deviation was .95. The results suggest that participants in the study had mastered

about 70% of the information presented in the intervention leaflet. After reviewing 183 published books, articles, papers, and research reports, Dochy, Segers, and Buehl (1999) concluded that prior knowledge is strongly associated with the construction of new conceptions or perceptions. Therefore, the relatively higher mastery of prior knowledge about the prevalence and nature of overweight or obesity, and the effects of physical activity on preventing this health threat (70%) in this study might result in relatively higher scores on the perception of severity, self-efficacy, response efficacy, intention, and might lead to relatively lower scores on response costs and vulnerability for all groups (Table 3). The considerably high or low scores might produce ceiling effects (Lammers & Badia, 2005), thus masking the potential effect of the motivational interventions.

Milne et al. (2002) found that the PMT-based intervention significantly increased the cognitions of PMT constructs, and exercise intentions, moreover, all these cognitive changes induced by the intervention on PMT constructs and intention remained stable over a 2-week period. However, whether the effects of the motivational intervention on PMT constructs and physical activity intention remain stable over the 4-week period of the present study was not examined. One of the reasons was that the motivational intervention did not significantly impact the participants' cognitions of PMT constructs and physical activity intention. The other reason was that the result of a significant main effect for time (Wilk's lambda = .87, $F(12, 312) = 4.05$, $p < .001$, $\eta^2 = .13$) suggested the cognitions of PMT constructs and physical activity intention changed over time. However, the time effect was not produced by the intervention as the interaction of condition × time was not significant. Some unclear factors might have produced this time effect.

Effects of Interventions on Physical Activity Behavior

There were no significant main effect for intervention conditions on participants' self-reported physical activity behavior and the interaction of condition × time was also not statistically significant. This implies that the interventions did not effectively promote the participants' physical activity behavior. Thus, the research hypothesis was not supported. The findings in this study indicated that PMT-based motivational intervention did not promote physical activity behaviors. This was consistent with the study conducted by Milne et al. (2002). They reported the PMT-based motivational intervention to undergraduate students had a significant impact on physical activity intentions but not on physical activity behavior in a 1-week follow-up. However, in a similar PMT-based motivational intervention to undergraduate students, Zhang et al. (2012) reported the intervention had significant positive effects on PMT constructs, physical activity intentions, and physical activity behavior. Graham et al. (2006) examined whether colon cancer was a meaningful source of exercise motivation. They found an intervention effect in exercise behavior at 2 weeks postintervention, but not at 4 weeks postintervention. These inconsistent results suggest further studies should be conducted on the effects of PMT-based motivational intervention to physical activity behavior. On the other side, a large body of published experimental studies have suggested that implementation intention interventions were successful in changing physical activity behavior (Armitage & Sorigg, 2010; Kwak, Kremers, Van Baak, & Brug, 2007; Luszczynska &Haynes, 2009; Milne et al., 2002; Prestwich, Perugini, & Hurling, 2010; Roberts, Maddison, Magnusson, & Prapavessis, 2010; Scholz, Knoll, Sniehotta, & Schwarzer, 2006; Sniehotta, Scholz, & Schwarzer, 2006; Zhang et al., 2012). However, the combined PMT-based motivational

intervention with implementation intention-based volitional intervention did not significantly promote adolescents' physical activity behavior in this study. This was evidenced by the lack of a nonsignificant main effect for intervention conditions on participants' self-reported physical activity behavior as well as the condition × time interaction. Although there was a significant main effect for time, it was not produced by the intervention as indicated by nonsignificant condition × time interaction. The inconsistent results of the current study with previous studies might again be traced to the inclusion of adolescent participants in the present study in comparison to the use of various adult participants in previous studies.

Body Weight Group Differences of PMT Constructs, Intention, and Behavior

The results of the study indicated that overweight/obese participants reported higher perceived vulnerability and response costs than normal weight participants did. Overweight/obese participants also reported significantly lower self-efficacy, physical activity intention, and physical activity behavior (Table 4). Therefore, the hypotheses that overweight/obese adolescents would rate their personal beliefs about the severity of the threat and personal vulnerability to the threat as higher than normal weight adolescents and overweight/obese adolescents would rate their personal self-efficacy and response efficacy lower than normal weight adolescents were partially supported. Although previous studies examined perceptions of PMT constructs, intention, and physical activity behavior among populations with a health threat and without a health threat after interventions, no study compared perceptions of PMT constructs, intention, and behavior between populations with and without health threat within a single study after receiving the same

intervention. For example, Zhang et al. (2012) tested the impact of combining a PMT-based motivational intervention plus an implementation intention-based volitional intervention on PMT constructs, intention, and exercise behavior. Participants were undergraduates who did not have a diabetes (targeted health threat) history. Milne et al. (2002) conducted a similar study with undergraduates. They did not report whether students who had coronary heart disease history were excluded from participation. Graham et al. (2006) and Courneya et al. (2001) examined whether colon cancer was a meaningful source of exercise motivation. Participants were physically inactive teaching and school staff (Graham et al., 2006) and undergraduate psychology students (Courneya et al., 2001). Participants who had colon cancer history were not excluded. Tulloch et al. (2009) tested the PMT in the prediction of physical activity intentions and behavior among cardiac patients. Similarly, Blanchard et al. (2009) examined the PMT in explaining variation in exercise intentions and behavior among cardiac patients. Plotnikoff et al. (2009) investigated the utility of the PMT in predicting aerobic physical activity and resistance training in a population sample of type 2 diabetes adults. Only one previous study (Plotnikoff et al., 2010) compared the utility of PMT in predicting physical activity intention and behavior between adult populations with type 1 and type 2 diabetes. The study reported that differences in the means between the two groups were found for perceived vulnerability, self-efficacy, and behavior. More specifically, individuals with type 1 diabetes had lower perceived vulnerability, higher self-efficacy, and engaged in more weekly minutes of physical activity compared to type 2 diabetes. Therefore, it was of valuable to further compare perceptions of PMT constructs, intentions, and behaviors between

populations with and without health threat or with different health threats within a single study after receiving the same intervention.

To my knowledge, there has been no previous study that compared perceptions of PMT constructs, physical activity intention, and physical activity behavior between overweight/obesity adolescents and normal weight adolescents. These results suggested that adolescents with the health problem have different cognitions of PMT constructs, physical activity intention, and physical activity behavior from adolescents without the health problem. Specific to the present study, compared to normal weight adolescents, overweight/obese adolescents tend to perceive that they are more likely to suffer from the health threat if they do not participate in physical activity. They also feel that participating in physical activity will cost more than normal weight adolescents. It was also implicated that overweight/obese adolescents have lower confidence to engage in physical activity than normal weight adolescents. The physical activity interventions for overweight/obese adolescents should focus on changing the perceptions of vulnerability to the health threat, self-efficacy to physical activity, and the perceptions of physical activity costs.

Associations Between PMT Constructs, Intention, and Behavior

The fourth purpose of this study was to test the PMT in predicting physical activity intention and physical activity behavior among adolescents, and to determine whether weight category moderate relationships between PMT constructs and physical activity intention or physical activity behavior.

The results revealed that physical activity intention and the PMT constructs of response cost and perceived vulnerability were significantly associated with physical activi-

ty behavior, explaining 6% and 8% of variance in physical activity behavior, respectively. In terms of physical activity intention, significant relationships with self-efficacy and response cost were observed, explaining 40% of the variance for intention. Weight category did not emerge as significant moderator in the association between PMT constructs and physical activity behavior, and the association between PMT constructs and physical activity intention.

This study found that intention and response cost were significant predictors associated with physical activity behavior, and self-efficacy and response cost were significant predictors of physical activity intention. It is partially in line with the findings of previous studies indicating that coping appraisal constructs (self-efficacy, response efficacy, response cost) were found to be significantly associated with physical activity intention and behavior (Fruin et al., 1991; Plotnikoff & Higginbotham, 2002; Plotnikoff et al., 2008; Tulloch et al., 2008; Wurtele et al., 1987). A meta-analysis (Floyd et al., 2000) revealed that coping appraisal constructs (especially self-efficacy) were the strongest predictors of protection motivation (i.e., intention) and behavior. However, in this study self-efficacy was not a significant predictor associated with physical activity behavior. It might be because the participants in this study already had quite high self-efficacy and the ceiling effect attenuated the strength of the relationship. The negative association between response cost and physical activity intention and physical activity behavior is consistent with previous studies. PMT (Rogers, 1983) assumed that response costs inhibit performance of the adaptive behavior (physical activity behavior in this case). Floyd et al. (2000) conducted a meta-analysis of 65 studies and reported a medium effect size for response cost. The current study found that response cost was negatively associated with

physical activity intention and physical activity behavior. Referring to statements of response cost items in the PMT questionnaire (see Appendix I), it implies that adolescents did not feel physical activities cost them too much spare time and too many other joyful activities will have higher intention and behavior.

The finding of a significant association between intentions and behavior is consistent with previous studies. Ajzen and Fishbein (1980) asserted that behavioral intentions predict actual behaviors. Plotnikoff et al. (2002) found a strong significant association between intentions and behaviors. In addition, a meta-analysis (Milne et al., 2000) revealed that the largest association in the PMT framework was between intention and behavior. Intention appeared to be a medium-to-strong average correlation with subsequent behavior. Thus, it can be inferred that intention is the best and most immediate predictor of behavior in the PMT model.

The results of the current study showed that perceived vulnerability (one of the PMT's threat appraisals constructs) was negatively associated with physical activity behavior. This finding is partially consistent with previous studies in the field of physical activity. The PMT proposed that perceived vulnerability should be positively related to health-protective intentions and behavior. However, previous physical activity studies showed limited or inconsistent associations between perceived vulnerability and physical activity behavior (Norman et al., 2005; Plotnikoff & Higginbotham, 2002; Wurtle & Maddux, 1987). Negative correlations between perceived vulnerability and health-related behaviors were found in several studies (Ben-Ahron et al., 1995; Plotnikoff & Higginbottom, 1998; Seydel et al., 1990). The negative association between perceived vulnerability and health-related behavior might be explained by "defensive avoidance" styles of coping

(Rogers, 1983; Seydel et al., 1990). When individuals felt vulnerable to a health threat, they would be more anxious and thereby engage in various maladaptive coping responses to deal with the anxiety associated with threat (e.g., denial, avoidance). Another explanation might be that individuals have already taken precautions (e.g., physical activity) to a certain health threat, thus they would feel less vulnerable to the health threat. Based on the results of lower cognition of perceived vulnerability in the present study, the negative association of perceived vulnerability with physical activity behavior might be due to precautions having been taken by participants.

Limitations

Caution is required in the interpretation of the findings as the following limitations were present in the study.

1. The study was limited to junior high school physical education students enrolled at a school in the Mountain West Region of the United States, which might limit the generalizability of the results beyond this sample.
2. Participants' high baseline levels of physical activity behavior and prior knowledge of overweight/obesity information and effects of physical activity might have influenced their response to PMT constructs.
3. There might be measurement issues. Most of the data was voluntary self-reported responses and the participants may have not answered truthfully.
4. Students might have exchanged information outside the study, thus their perceptions and attitudes could be affected.

Implications

The results of the current study suggest the following implications:

1. To raise the intervention effect, quality intervention materials matching adolescents should be developed. For example, more environmental and intrapersonal information should be added.
2. Overweight/obesity might not be a strong health threat source to initiate adolescents' physical activity participation in PMT model.
3. When developing PMT-based interventions to promote adolescents' physical activity participation, differences for cognitions of PMT constructs between overweight/obese adolescents and normal weight adolescents should be noticed.
4. Interventions to promote adolescents' physical activity participation should focus on their beliefs in their ability to engage in physical activity, perceptions of physical activity costs, and intentions to engage in physical activity.

Recommendations

Recommendations for future study are as follows:

1. This study can be replicated to examine the intervention effects among elder adolescents (high school students).
2. Other health threats (e.g., coronary heart disease, cancer) may be employed as sources of information to promote physical activity behavior.
3. PMT may combine with other theories to develop physical activity interventions.

4. A pilot study should be conducted to assess the feasibility of the study, establish whether the sampling frame and technique are effective, and collect preliminary data. Specifically, students' base levels of physical activity intention and behavior should be evaluated in the pilot study. The PMT questionnaire and intervention materials should be tested.
5. The effects of interventions over a longer time period should be examined in future studies.

Conclusions

In conclusion, the PMT-based motivational intervention failed to change adolescents' perceptions of PMT constructs, physical activity intention, and physical activity behavior in this study. Combining a PMT-based motivational intervention with an implementation intention-based volitional intervention seemed not to be effective enough to promote adolescents' physical activity behavior.

Overweight/obese adolescents perceived different levels of most of the PMT constructs, physical activity intention, and physical activity behavior compared to the normal weight adolescents. Specifically, overweight/obese adolescents felt more likely to be overweight/obese if they did not change their physical activity behavior, and it cost more to participate in physical activity than normal weight adolescents did. Overweight/obese adolescents have lower confidence to engage in physical activity than normal weight adolescents. Their physical activity levels and intention to participate in physical activity were also lower than normal weight adolescents'. Even though overweight/obese adolescents had different perceptions, they did not respond to either intervention differently than normal weight adolescents.

The statistically significant association of adolescents' physical activity behavior with response cost, perceived vulnerability, and intention was demonstrated in this study. Adolescents' intention to physical activity participation was statistically predicted by self-efficacy and response costs.

INSTITUTIONAL REVIEW BOARD
THE UNIVERSITY OF UTAH

IRB: IRB_00054539

PI: Chaoqun Huang

Title: Effects of Motivational and Volitional Interventions on Children's Physical Activity Behavior

This New Study Application qualifies for an expedited review by a designated University of Utah IRB member as described in 45 CFR 46.110 and 21 CFR 56.110. The research involves one or more activities in Categories 4 and 7 (published in 63 FR 60364-60367). The designated IRB member has reviewed and approved your study as a Minimal risk study on 1/19/2012 . Federal regulations and University of Utah IRB policy require this research protocol to be re-reviewed and re-approved prior to the expiration date, as determined by the designated IRB member.

Your study will expire on 1/18/2014.
Any changes to this study must be submitted to the IRB prior to initiation via an amendment form.

Contingent Approval Pending School District/Principal Approval: This approval is contingent upon submission of final approval from Murray School District and a letter of support from the principal of Riverview Jr. High School. You must submit these letters to the University of Utah IRB by way of Amendment. The letters must be signed to be considered valid. Your University IRB approval will not be considered final and no research-related procedures may be conducted at that site until the Amendment is approved.

APPROVED DOCUMENTS

Protocol Summary
ResearchSummary_Effects of Interventions on PA_1_18_12_cleaned.doc

Parental Permission Forms
ParentalPermission-Effects of Interventions on PA_1_18_12_cleaned.doc

Assent Forms
ASSENT-Effects of Interventions on PA_1_18_12_cleaned.doc

Surveys, etc.
Leaflet and Questionnaires_12_31_11.doc

Other Documents
Flyer_Effects of Interventions on PA_1_18_12_cleaned.doc
Memo.doc

Click IRB_00054539 to view the application and access the approved documents.
Please take a moment to complete our customer service survey. We appreciate your opinions and feedback.

INSTITUTIONAL REVIEW BOARD
THE UNIVERSITY OF UTAH

IRB_00054539

Principal Investigator: Chaoqun Huang

Title: Effects of Motivational and Volitional Interventions on Children's Physical Activity Behavior

This Amendment Application (support letters from school district and school) qualifies for an expedited review by a designated University of Utah IRB member according to University IRB policy. The designated IRB member has reviewed and approved your amendment request for this study on 2/28/2012 . The approval of this amendment request does NOT change the expiration date of this research study as noted below.

Your study will expire on 1/18/2014 12:00 AM.
Any future changes to this study must be submitted to the IRB prior to initiation via an amendment form.

APPROVED DOCUMENTS

Other Documents
school district support letter.pdf
school support letter.jpg

Click AM_00011914 to view the application and access the approved documents.

Please take a moment to complete our customer service survey. We appreciate your opinions and feedback.

APPENDIX B

SCHOOL DISTRICT APPROVAL LETTER

Dr. Steven K. Hirase
Superintendent of Schools

Murray City School District

February 14, 2012

Department of Exercise and Sport Science
Chaoqun Huang, Ph.D. Candidate
250 S. 1850 E. Rm 247
University of Utah
Salt Lake City, Utah 84112-0920

Dear Chaoqu Huang:

As members of the Teaching and Learning Department, we are delighted to support your motivational and volitional intervention project (Title: Effects of Motivational and Volitional Interventions on Children's Physical Activity Behavior). This project is to help and encourage the students at Riverview Junior High to be aware of health threat of obesity/overweight and to make healthy choices, i.e. physical activity participation, to overcome the risks of obesity/overweight. We understand that the goal of this project is to support and create educational and social influences on students. This will facilitate the increased adoption of healthy lifestyles in helping students become more physically active.

We share a common purpose of wellness for all students. As a partner in this work, we are committed to supporting the motivational and volitional interventions project by disseminating information about the project, encouraging and supporting collaboration with the conduction of this project.

The motivational and volitional interventions project will be a wonderful addition to the work of the Murray School District, and we are very excited about the promise it holds for student wellness and interagency collaboration.

Sincerely,

Director of Teaching and Learning Department

147 East 5065 South ■ Murray, Utah 84107
(801) 264-7400 ■ Fax (801) 264-7456

APPENDIX C

SCHOOL APPROVAL LETTER

Riverview Junior High School

Murray City School District
751 West Tripp Lane (5750 So.) • Murray, Utah 84123 • (801) 264-7446 • (801) 264-7458
James Bouwman, Principal • C. Dolph Church, Assistant Principal

February 10, 2012

Department of Exercise and Sport Science
Chaoqun Huang, Ph.D. Candidate
250 S. 1850 E. Rm 247
University of Utah
Salt Lake City, Utah 84112-0920

Dear Chaoqu Huang:

Riverview Jr. High School is delighted to support your motivational and volitional interventions project (Title: Effects of Motivational and Volitional Interventions on Children's Physical Activity Behavior). This project is to help and encourage the students at junior high schools to be aware of health threat of obesity/overweight and to make healthy choices, i.e. physical activity participation, to overcome the risks of obesity/overweight. We understand that the goal of this project is to support and create educational and social influences on students. This will facilitate the increased adoption of healthy lifestyles in helping students become more physically active.

We share a common purpose of wellness for all students in our school. As a partner in this work, we are committed to supporting the motivational and volitional interventions project by disseminating information about the project, encouraging and supporting collaboration with the conduction of this project.

The motivational and volitional interventions project will be a wonderful addition to the work of the Murray School District, and we are very excited about the promise it holds for student wellness and interagency collaboration.

Sincerely,

Jim Bouwman
Principal Riverview Junior High

APPENDIX D

ASSENT TO PARTICIPATE IN A RESEARCH STUDY

Assent to Participate in a Research Study

Who are we and what are we doing?
We are from Department of Exercise and Sport Science, the University of Utah. We would like to ask if you would be in a research study. A research study is a way to find out new information about something. This is the way we try to find out how kids feel about the effect of knowing facts about obesity and role of physical activity in avoiding obesity on physical activity participation.

Why are we asking you to be in this research study?
We are asking you to be in this research study because we want to learn whether reading a factual health education leaflet and planning exact place, time and mode to participate in physical activity will change your thinking about obesity or overweight, intentions to physical activity and physical activity participation. The health education leaflet will contain factual information about the prevalence and nature of obesity/overweight and the effects of physical activity on preventing this health threat. We want you to be in this study because this study will focus on the students from 7th grade to 9th grade.

What happens in the research study?
If you decide to be in this research study and your parent or guardian agrees, this is what will happen. We will ask you read a leaflet and complete the enclosed questionnaires. It will take about 20 minutes. We will also ask you wear a pedometer to measure your step counts in physical education classes. We will collect data three times over a period of 4 weeks.

Will any part of the research study hurt you?
There is a chance that during this research study you could experience burdens of boredom, frustration etc. related to answering a lot of questions, and injuries related to participating in physical activities. We will try to help you feel better if this happens. You can stop at any time if you want to.

Will the research study help you or anyone else?
We do not know for sure if being in this research study will help you. However, we hope the information getting from this study may help develop a greater understanding of issues associated with student physical activity behaviors and to design effective interventions to promote students' daily physical activity levels.

Who will see the information about you?
Only the researchers will be able to see the information about you from this research study. We will not tell anyone else that you are in the study.

What if you have any questions about the research study?

It is okay to ask questions. If you don't understand something, you can ask us. We want you to ask questions now and anytime you think of them. If you have a question later that you didn't think of now, you can call Chaoqun Huang at 801-349-9099 or ask us the next time we see you.

Do you have to be in the research study?

You do not have to be in this study if you don't want to. Being in this study is up to you. No one will be upset if you don't want to do it. Even if you say yes now, you can change your mind later and tell us you want to stop. You can take your time to decide. You can talk to your parent or guardian before you decide. We will also ask your parent or guardian to give their permission for you to be in this study. But even if your parent or guardian say "yes" you can still decide not to be in the research study.

Agreeing to be in the study

I was able to ask questions about this study. Signing my name at the bottom means that I agree to be in this study. My parent or guardian and I will be given a copy of this form after I have signed it.

_____

Printed Name

_____ _____

Sign your name on this line Date

_____

Printed Name of Person Obtaining Assent

_____ _____

Signature of Person Obtaining Assent Date

The following should be completed by the study member conducting the assent process if the participant agrees to be in the study. Initial the appropriate selection:

_____ The participant is capable of reading the assent form and has signed above as documentation of assent to take part in this study.

_____ The participant is not capable of reading the assent form, but the information was verbally explained to him/her. The participant signed above as documentation of assent to take part in this study.

APPENDIX E

PARENTAL PERMISSION TO PARTICIPATE IN RESEARCH

Parental Permission to Participate in Research

You are being asked to allow your child to participate in a research study. Before you agree, we must tell you why the research is being done and what it will involve. Please take time to read the following information carefully. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you will allow your child to take part in this study.

The purpose of this research study is to evaluate whether reading a factual health education leaflet and planning exact place, time and mode to participate in physical activity will change your child's thoughts to obesity or overweight, intentions to physical activity and physical activity participation. The health education leaflet will contain factual information about the prevalence and nature of obesity/overweight and the effects of physical activity on preventing this health threat. Your child will be randomly assigned to one of the three groups based on the PE class enrollment: Group 1 (control group), Group 2 (motivational intervention), and Group 3 (motivational intervention and volitional intervention). We would like to ask your child to read a leaflet and complete the enclosed questionnaires. It will take about 20 minutes. We would also like to ask him/her to wear a pedometer to measure their step counts in physical education classes. We will collect data three times over a period of 4 weeks. There may be burdens of boredom, frustration etc. related to answering a lot of questions, and injuries related to participating in physical activities. Inadvertent disclosure of study data may be the possible risk of loss of confidentiality. However, all the data and records will be only used for research purpose and stored in a locked filing cabinet and on a password protected computer located at my office. Only researchers of this project can reach them. Results of the study may be published, but no names or identifying information will be included in the publication. Participant identity will remain confidential unless disclosure is required by law.

There are no direct benefits for taking part in this study. However, We hope the information from this study may help develop a greater understanding of issues associated with student physical activity behaviors and to design effective interventions to promote students' daily physical activity levels. It is up to you to decide whether to allow your child to take part in this study. Refusal to allow your child to participate or the decision to withdraw your child from this research will involve no penalty or loss of benefits to which your child is otherwise entitled. This will not affect your or your child's relationship with the investigator. This study will not interfere with your child's normal class time and will not affect their relationship with the school staff and faculty. We will also ask your child for their assent to participate in this study. They can also say no even if you give permission. Your child can also choose not to finish the questionnaire, withdraw from the study, or omit any question he/she prefers not to answer without penalty or loss of benefits.

If you have questions, complaints or concerns about this study, you can contact Chaoqun Huang at 801-349-9099. If you need to contact someone for an injury that resulted from being in this study, please call Chaoqun Huang who may be reached 24-hours a day at 801-349-9099.

Institutional Review Board: Contact the Institutional Review Board (IRB) if you have questions regarding your rights as a research participant. Also, contact the IRB if you

have questions, complaints or concerns which you do not feel you can discuss with the investigator. The University of Utah IRB may be reached by phone at (801) 581-3655 or by e-mail at irb@hsc.utah.edu.

Research Participant Advocate: You may also contact the Research Participant Advocate (RPA) by phone at (801) 581-3803 or by email at participant.advocate@hsc.utah.edu.

Your child's participation in this research is voluntary, and he or she will not be penalized or lose benefits if you refuse to allow participation or decide to stop.

Please call (801)3499099 or send an email to chaogun.huang@hsc.utah.edu to opt your child out of the study if you **do not** want them to participate in the research. Parental Permission for your child to be in this study will be assumed if you do not opt your child out after 1 week.

APPENDIX F

INTERVENTION MATERIALS

Health Education Leaflet

The following passage presents a true account of the effect physical activity has on reducing the risk of obesity/overweight. Information contained in this leaflet was constructed from *Overweight and Obesity* (Centers for Disease Control and Prevention: http://www.cdc.gov/obesity/).

Did you know that the percentage of overweight children and adolescents in the US has nearly tripled since 1980s Approximately 17% (or 12.5 million) of children and adolescents aged 2—19 years are obese.

Obese children are more likely to have **high blood pressure, high cholesterol, breathing problems, joint problems and musculoskeletal discomfort, type 2 diabetes, discrimination, depression, and poor self-esteem**. Obese children are **more likely to become obese adults**. If children are overweight, obesity in adulthood is likely to be more severe. (*Perceived severity*)

In 2008, **more than one third** of children and adolescents were overweight or obese. Physical inactivity children has shown to be a serious cause, and **children who fail to engage in regular physical activity are at greater risk of obesity**. Many children fail to exercise because they are spending time doing stationary activities such as computer usage, playing video games, or watching television. TV and other technology may be large factors of physically inactive children. (*Perceived vulnerability*)

Physical activity plays several important roles in the prevention and control of obesity, and it is essential for health at any weight. Increased physical activity and decreased sedentary behavior are associated with lower rates of obesity, and it reduces

the risk for many of the diseases associated with obesity, such as diabetes and heart disease. (*Response efficacy*)

Most of children and adolescents **have the cognitive and physical ability to engage in regular physical activity**. You should do 60 minutes (1 hour) or more of physical activity each day. This may sound like a lot, but don't worry! You may already be meeting the *Physical Activity Guidelines for Americans*. And, you'll soon discover all the easy and enjoyable ways to help you meet the recommendations. Examples of age-appropriate, enjoyable, and various activities are brisk walking, running, gymnastics, push-ups, jumping rope etc. If you still doubt about your ability to find an exercise you could do, imagine you doing a few different exercises and you would soon find one you feel confident in trying. (*Self-efficacy*)

Although adopting a regular physical activity lifestyle does have its costs, most children find these to be very minor and easily overcome and find that the benefits of a regular physical activity lifestyle far outweigh the costs. (*Response costs*)

APPENDIX G

IMPLEMENTATION INTENTION INTERVENTION

Implementation Intention Intervention

Many students find that they intend to take part in physical activity but then forget. It has been found that if you form a definite plan of exactly when and where you will carry out an intended action you are more likely to actually do so and less likely to forget or find you don't get round to doing it. It would be useful for you to plan when and where you will exercise in the next two weeks. Please complete the following statements.

Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, being active with friends, or walking to school. Examples are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, football, and surfing.

During the next 2 weeks I will participate in at least 60 minutes of physical activity on the following specific day(s), time, and place(s).

	Day	Time	Place	Physical Activity (ies)
Week 1	Monday ○			
	Tuesday ○			
	Wednesday ○			
	Thursday ○			
	Friday ○			
	Saturday ○			
	Sunday ○			
Week 2	Monday ○			
	Tuesday ○			
	Wednesday ○			
	Thursday ○			
	Friday ○			
	Saturday ○			
	Sunday ○			

APPENDIX H

PMT CONSTRUCTS AND INTENTION QUESTIONNAIRE

PMT Constructs and Intention Questionnaire

Direction: Please read each of the following statements and circle the response which best expresses your feeling. There are no right or wrong answers. Please answer how you really feel.

1) My chances of developing overweight/obesity in the future are (PV).

Not At All Strong				Very Strong
1	2	3	4	5

2) I am unlikely to develop overweight/obesity in the future (PV-R).

Strongly Disagree				Strongly Agree
1	2	3	4	5

3) If I were to develop overweight/obesity I would suffer a lot of health problems (PS).

Strongly Disagree				Strongly Agree
1	2	3	4	5

4) Participating in physical activity at least 60 minutes a day is a good way of reducing the risk of developing overweight/obesity (RE).

Strongly Disagree				Strongly Agree
1	2	3	4	5

5) I feel confident in my ability to participate in physical activity at least 60 minutes every day in the next two weeks (SE).

Strongly Agree				Strongly Disagree
1	2	3	4	5

6) It would not be difficult for me to participate in physical activity at least 60 minutes every day in the next two weeks (SE-R).

Strongly Agree Strongly Disagree

1 2 3 4 5

7) I do not wish to participate in physical activity at least 60 minutes every day during the next two weeks (I).

Strongly Agree Strongly Disagree

1 2 3 4 5

8) Participating in physical activity at least 60 minutes every day in the next two weeks would be easy for me (SE).

Strongly Disagree Strongly Agree

1 2 3 4 5

9) I am discouraged from participating in physical activity at least 60 minutes every day in the next two weeks because I feel unable to do so (SE).

Strongly Agree Strongly Disagree

1 2 3 4 5

10) The benefits of taking physical activity at least 60 minutes every day outweigh the costs (RC).

Strongly Agree Strongly Disagree

1 2 3 4 5

11) Taking physical activity at least 60 minutes every day in the next two weeks would cause me too many problems (RC).

Strongly Disagree Strongly Agree

1 2 3 4 5

12) I would be discouraged from taking physical activity at least 60 minutes every day in the next two weeks as it would take too much time (RC).

Strongly Disagree Strongly Agree

1 2 3 4 5

13) I would be discouraged from taking physical activity at least 60 minutes every day in the next two weeks because I would feel silly doing so (RC-R).

Strongly Agree Strongly Disagree

1 2 3 4 5

14) I intend to participate in physical activity (e.g. sport, swimming, aerobics, dancing, running or walking briskly) at least 60 minutes every day during the next two weeks (I-R).

Strongly Agree Strongly Disagree

1 2 3 4 5

APPENDIX I

OVERALL PHYSICAL ACTIVITY QUESTIONNAIRE

Overall Physical Activity Questionnaire

Directions: **Physical activity** is any activity that increases your heart rate and makes you get out of breath some of the time. **Physical activity** can be done in sports, playing with friends, or walking to school. Some examples of **physical activity** are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, football, and surfing.

Add up the times you spend in physical activity each day. Circle the answer that best applies to you.

1) How many days during a typical week were you physically active for at least 60 minutes?

   0 days 1 2 3 4 5 6 7

2) How many days during the past week were you physically active for at least 60 minutes?

   0 days 1 2 3 4 5 6 7

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